AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS, AND BLACKSMITHS.

VOL. 9, No. 42. WEEKLY. | NEW YORK, OCTOBER 16, 1886. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

COPYRIGHT 1886, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

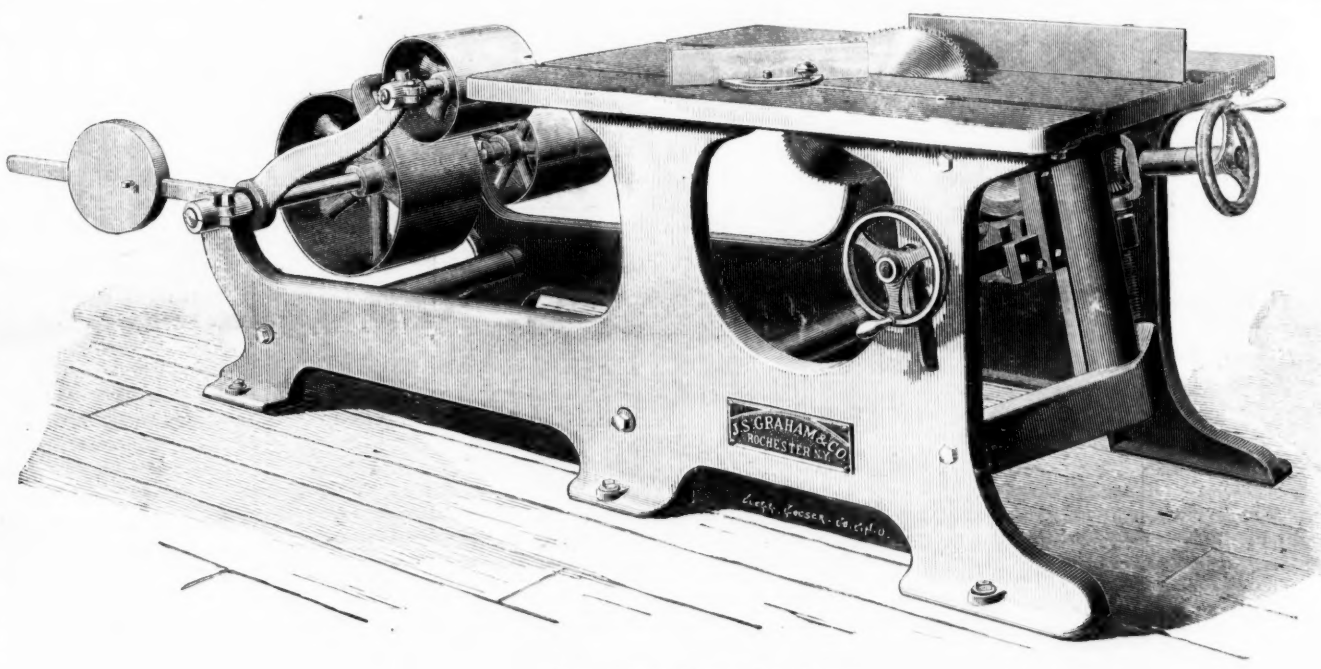
Combination Mitre Saw Table.

This illustration represents the latest improvement in a combination saw bench by J. S. Graham & Co., Rochester, N. Y., which is particularly adapted to use in casket works, furniture, piano, sash and blind factories, car, picture frame and pattern shops, or any establishments where plain, bevel or mitre sawing is required to be done in a rapid and perfect manner.

It is designed with special reference to strength and simplicity.

The whole machine is constructed of iron and steel. The table is one piece, four feet by three feet, accurately planed, and bolted firmly to the frame. It is fitted with the necessary groove slides for ripping and cross cutting gauges. It is also provided with removable piece allowing the use of wobble saws, dado head, etc.

The saw is raised and lowered to any desired height by the hand wheel in front of the machine, and can be set to any angle up to 45 degrees, or a mitre by turning the hand wheel at the side of the machine. An accurate index, with the degrees of angle, is at the front of the machine in sight of the operator.



COMBINATION MITRE SAW TABLE.

The table is provided with an improved bevel slitting gauge and cross cut or mitering gauge, which, in connection with the angular adjustment of the saw, enables the operator to get every conceivable plain or double miter ever required. The top of the saw table is the pivot that the saw swings on, hence there is no necessity for sliding or tipping table for any purpose. The table is slotted for and furnished with a 16-inch cross cut saw.

The countershaft and tightener are a part of the machine, and can be run wherever a belt can be brought to them. The tight and loose pulleys are 12 by 6, and should be speeded to suit the saw.

Manufacturing by Proxy.

A few years ago whatever the invention a man made in the way of machinery, if he wished to control its sale and introduction he must generally contrive to own a machine shop in which to manufacture it. This has ceased to be a matter of necessity, and is coming every year to be less and less a matter of policy. The shops are all the time increasing in number in which it is expected that a large part of the work will be manufacturing for others whose names alone will be associated with the manufactured article. Much experience makes it possible for such shops to take hold of new manufactures that come in their way easily, and to do the work at low cost. Many times a man handles a good deal of his own machinery, being nominally the manufacturer, and still has literally nothing to do with the manufacture, or with its troubles and worry. Often he is much better off for an arrangement of this sort than if he were obliged to make a large investment in the way of facilities for manufacturing. It leaves a good deal of capital free for the selling part of the business, and permits him to concentrate his efforts instead of having to divide them. It may enable him to control a large business, which he would not be able to do if his means must be locked up in a plant for manufacturing.

Vertical Engines for High Speed and High Steam.

BY WILLIAM H. HOFFMAN.

The vertical engine becomes a necessity when large cylinders are required, as the pistons of horizontal engines are too heavy to move economically, even though they may be guided at both ends of the cylinder by the extension of the piston rod through the back cylinder head, and then connecting to a second cross-head.

Some five years ago the writer saw some large blowing engines at the Bethlehem Iron Company's Works that were of the compound horizontal type, the low pressure cylinder being about 72", and this piston was balanced in the cylinder, by steam being admitted under it, and this novel device worked to perfection. I believe Mr. Johnston, the master mechanic and engineer of the company, was the inventor and builder of this method of balancing. High speed and high steam, however, will hardly admit of the general use of steam balanced horizontal pistons, as any failure to act would cause serious cutting immediately. It appears, then, that we must look to the vertical style of engine, where cylinders above 54" are used, and where the piston speed is above 500 feet per minute. In designing such engines, there is one vital factor that must be observed, viz., stability, and I think the majority of the constructing engineers will admit that the average vertical engine of the present time, working under high steam, is decidedly unsteady when doing its maximum work. In marine engines this fault is not easily remedied, as the structure on which the engine rests is quite elastic, and the space limited. On land, however, we have plenty of room for a wide engine base, and can put in any amount of metal necessary to secure a firm hold for the uprights or housings. The principal trouble with the average vertical engine, is a lack of base, as this is usually not wide enough, and offers very little bracing to the frames under a moderately high speed, and the tops of the uprights and cylinders show a very unpleasant weaving motion.

I saw a vertical engine not long ago, that not only had a serious vibrating motion at the cylinder tops, but the frames were so badly proportioned at the base that they were drawn inward at the lower end of the guides fully $\frac{3}{4}$ of an inch at each revolution of the engine.

It is unnecessary to add that the guides of this engine were never cool, and the gibs on the crosshead were never in their proper position, for if they had been they would have melted out of their seats from friction.

It is not an unusual occurrence to see vertical engines constructed on the proportions just cited, with "after consideration" braces thrown in here and there, and with the only result of adding very much to the ugliness of the machine design, but rendering no actual service to the weak structure. Pig iron is now certainly cheap, and I can see no excuse for this false economy in the construction of heavy steam engines. An English designer of a well known company who build torpedo boats, lately told me in connection with this matter that he had used wrought iron, wrought steel, heavy boiler plate, and rolled beams for engine uprights, but he had yet to find the equal of good cast iron for this purpose. Of course the object of the torpedo boat builder in using the wrought metals, was to bring the engines to a minimum in weight, and although he accomplished everything required in the way of tensile and compressive strength, still he was sadly lacking in stability, and they were therefore obliged to reduce the speed of the engines in order to prevent serious vibration.

The above illustration holds good on engines of all sizes, and when we come to those of large powers, we find that stiffness and a liberal base are items of the greatest importance, and if the rules of stability are not observed in the original design, it is a very difficult matter to successfully apply a system of "patch work" bracing.

Daily newspapers have been bothered for some years with occasional dispatches about some astonishing occurrence, as, for instance, a shower of meat or the fall of a great meteor. Most of these yarns were made up by Joe Mulhattan, a commercial traveler. The dailies have not been tricked so much since they have become familiar with Joe's peculiar style in making up a story. Recently, however, it is reported that he has given the dailies a rest, and turned his attention to industrial newspapers. The following item, which we find in the *Industrial World*, seems to give confirmation to that report:

Bentley & Knight, Rhode Island Locomotive Works, have constructed for the Underground Railway of New York an electromotive engine, which is said to be the largest electro-motor yet made. Two electro-motors coupled together give a joint power of 500,000 watts—equal to 670 horse-power. All the ordinary electrical appliances are employed on this engine, working automatically.

We advise our contemporaries to look out for Joe Mulhattan, for he is equal to the inventing of underground railroads and immense electric locomotives that work automatically any time when there is a lull in exciting industrial news.

Evening Schools for Mechanics.

In many of the cities and large manufacturing towns in the country evening schools for mechanics will be in operation next winter. There are many more cities and towns in which such schools ought to be established. Not from any sentiment of humanitarianism—we are not referring to that now—but upon pure business principles.

Mechanics of the wide-awake, progressive kind appreciate the benefit likely to be derived from studying more of mechanics than they are able to do in the workshop, and as a consequence will gravitate to those places where

facilities for study outside of working hours are afforded them. As a consequence the best and brightest—the most industrious—men will be found in those places where evening schools for mechanics are in working order.

Manufacturers will do well to give this matter attention. It will surely have, in the future, an influence on the kind of mechanics to be found in any particular locality. The expense of maintaining such schools is a mere trifle compared to the bringing to a city or town the kind of young men that spend their leisure in study.

Production of Aluminum Bronze Metal.

By Thomas D. West.

The strife of metallurgists to produce strong material for engineering and machine construction has been, and always will be, an animated one. Until quite recently our strongest articles in metals were only obtainable by means of forging, a method which is not only expensive, but limited as to character of forms. At present but few shapes exist that cannot in our strongest metals be cast or formed in moulds of sand, etc., as is seen by the steel and "Mitis" castings produced in Europe and in this country. The field occupied by these two metals will, to an extent, be invaded by the coming production of aluminum—a metal which, when alloyed with copper, has a tensile strength of 100,000 lbs. to the square inch. An alloy containing 10 per cent. of aluminum and 90 per cent. of copper, forms the so-called aluminum bronze It has a golden color, which it retains for all time. This alloy has stood a tensile strain of 131,000 lbs. per square inch in a casting, this being an exceptional result. An alloy containing 5 per cent. aluminum is a close approximation in color to 18 karat gold, and does not tarnish readily. Its tensile strength in the form of castings is greater than that of gun metal, or 90 parts of copper and 10 parts of tin. An alloy containing 2 or 3 per cent. aluminum is stronger than brass, possesses greater permanency of color, and would make an excellent substitute for that metal. When the percentage of aluminum reaches 13 an exceedingly hard brittle alloy is obtained, and higher percentages increase the brittleness, and the color becomes a silvery white. With 25 per cent., and upwards, of aluminum, alloyed with copper, the strength again increases; the alloys are white, but still continue to be brittle.

As the aluminum, which is the base of this alloy, and gives to it such great strength, has heretofore been a metal too costly to produce for commercial trade, a description of its extraction or manufacture by a process which excels all known methods for the reduction of our most refractory oxides, and one which has so greatly reduced the cost of producing aluminum, must now be of interest.

Pure aluminum itself is a white metal, having a beautiful silver luster; it is one of the lightest in weight of all the true metals, being about twice and one-half times heavier than the same volume of water, while iron is about eight times as heavy. It has neither taste nor odor, and is nearly as soft and malleable as gold. Its tensile strength, compared with like weight of good steel, is about the same, and its melting point is about 1000° F. being between that of silver and zinc. It is two and three-tenths times a better conductor of electricity and heat, when compared weight for weight, than copper or silver. It readily alloys with all metals except lead, and seems to improve them, and in the future it will no doubt be greatly employed in the mechanic arts.

Aluminum has never been found in a pure state in the earth, as is the case with copper, silver and gold, but is invariably found chemically combined with some other natural element, like oxygen, sulphur, or as in the case of common clay, with oxygen and silicon. It is thus found in combination with other elements in no less than 195 species of minerals; and is, with the exception of silicon and oxygen, the most common element of the earth's crust. It is the metallic base of many of the gems, such as the ruby, sapphire and oriental topaz, as well as the ordinary clays, slates and alums. Corundum or alumina is its richest ore, and is that now being used for reduction in the electric furnance here shown. Aluminum is simply alumina deprived of its natural affinity, oxygen. The difficulty which has stood in the way of utilizing this abundant ore has been the inability to obtain a sufficiently high temperature to reduce it. It was found that the only way to secure the requisite temperature and deprive the alumina of the oxygen was by the construction of an electric furnace, wherein the temperature is virtually unlimited, and in this furnace, with the air excluded, it has been found that carbon or charcoal will readily reduce the oxide of aluminum and other refactory oxides, such as rutile, titanic oxide, lime, (calcium oxide), magnesia, magnesium oxide, etc.

This furnace gives a temperature and produces results that have been sought after by the great metallurgists and chemists of the world for the past half century, and the foresight and energetic labors of Messrs. Eugene H. and Alfred H. Cowles, in accomplishing what they have, cannot be too favorably commented upon.

In the reduction of corundum (oxide of aluminum) for the production of aluminum by the electric furnace, here shown, the sides and bottom of furnace are protected from fusion by a wall and bed of fine charcoal dust, the heat of the furnace being so great

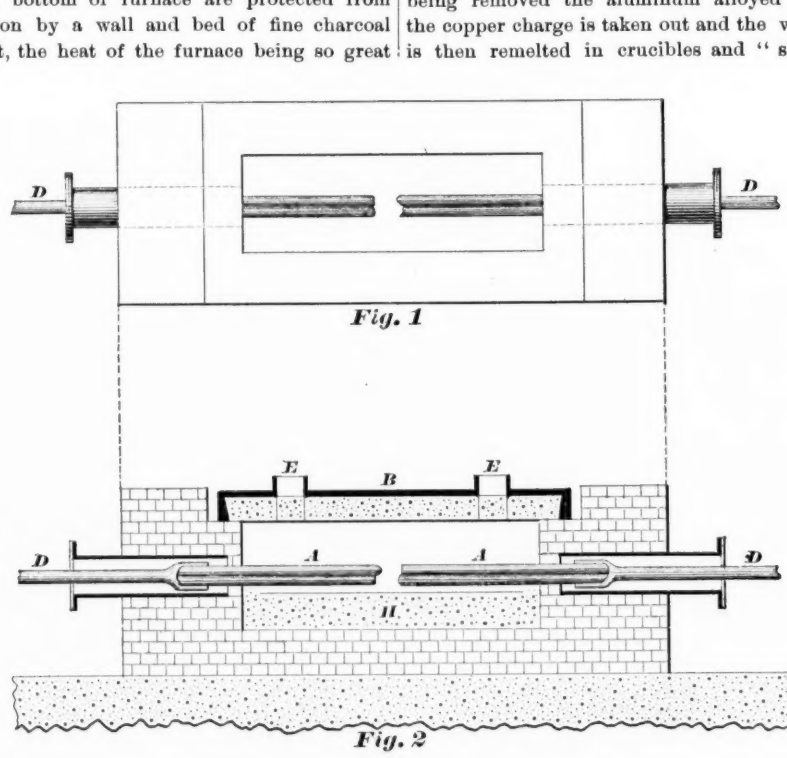


Fig. 1

Fig. 2

that were this not done the fire-bricks composing the walls would be reduced to a liquid mass. After the charcoal bottom and walls are in, a charge, consisting of fifteen parts of corundum, forty parts of copper (which, by the way, is granulated by being poured into a deep bath of cold water) and charcoal, these having been well mixed, are then placed or charged over, and about what are termed "carbon electrodes," shown at *A* in elevation view of furnace. The whole being covered with charcoal dust, the furnace is then covered with the lid *B*, and copper rods *D D*, connected with wire, which carry electricity from what is at present the largest dynamo in the world to charge in furnace.

The dynamo was designed by Mr. C. F. Brush, and the following figures, taken from *Iron Trade Review*, will give an idea of its size and power:

	Pounds.		Pounds.
Armature	4,300	Brush lever	18
Eight magnets	9,295	Pole pieces	67⅛
Rails	800	Pole piece stands	18
Chair (pulley)	2,300	Chair braces	148⅛
Chair (front)	2,050	Bolts	252
Wrenches	26	Pulley cap	526
Segments	15⅛	Chair blocks	293
Oil cups	10⅛	Commutator box	527
Pulley key	6	Rocker stands	379
Brushes	6	Pulley	500
Connection board	22⅛	Total	21,671⅛
Shunt cables	5		
Brush clamps	37	Or 10 tons, 1,671⅛ lbs.	
Brush rockers	69		

The dynamo has been driven at a speed of 410 revolutions, giving a current of 3,000 amperes of 83 volts electromotive force in the external circuit. The amount of current in the field was over 80 amperes, which alone would be considered a good external current from an ordinary sized lighting machine; 355 horse-power was the limit of the engine that produced these results.

It is now connected with a 550 horse-power Victor turbine. The immense energy of this powerful current is entirely confined to the small charcoal space filled with the charge. The mass of corundum copper and charcoal becomes incandescent by the electric current. A most intense heat being thereby attained, the charge is effectually reduced in the short space of about two hours. The gases thrown off during the reduction are allowed to escape through open holes at *E E*, and being ignited as soon as they appear, burn quietly until no longer generated. The protection afforded the walls by the charcoal is perfect so far as the heat is concerned. The hand can be placed most anywhere on the furnace without fear of unpleasant results.

The energy consumed by the reduction of the ore is almost entirely electrical, only enough carbon being used to unite with the oxygen of the ore to carry it out of the furnace in the form of carbon monoxide, the aluminum remaining behind. The charge having been reduced, the electric current is then taken off and atached to another furnace, there being several in a row. The cover being removed the aluminum alloyed with the copper charge is taken out and the whole is then remelted in crucibles and "standardized;" which means tests are taken of its strength, and if any special grade of aluminum bronze is desired, "rich metal" or copper is added to raise or lower its strength. "Rich metal" is the product of a charge coming from the furnace high in aluminum. The metal having been standardized it can then be poured into moulds or ingots for shipment.

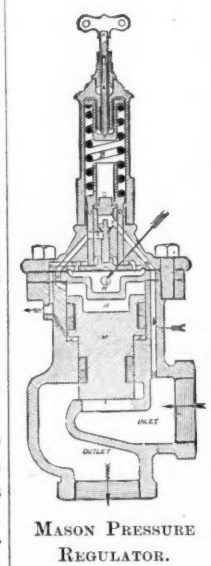
The metal is now ready for the founders' use, and the writer's experience with the new metal warrants him in saying that as great a difference will exist in methods for moulding "aluminum bronze" and cast-iron as now exist between the latter and steel.

There are some difficulties to be overcome in the casting of aluminum bronze, but these are being lessened every day. The metal has its own particular field, and like all new metals it will soon find that which it is best adapted for. The range for its use is wide and the limit cannot be now foretold. The stone, the bronze, the iron and steel ages have each had their turn; indications now point to the next being an age for aluminum and its alloys.

There are at least a hundred manufacturers of the "best" steam engines in the market; yet there are no serious objections raised when some one makes a "better" engine. We commend the forbearance of steam engine builders to those who are inclined to be captious in such matters.

The Mason Pressure Regulator.

The Mason Pressure Regulator works on the principle of an auxiliary valve actuated by the water pressure, thereby controlling the admission of steam to the upper surface of the differential piston which constitutes the main valve. The hydraulic pressure is admitted into the closed chamber at *O* by connection with the discharge pipe of the pump. If the pressure rises above the desired amount, the diaphragm *C C* is lifted, carrying with it the auxiliary valve *F* and opening the passage from *X* to *Z*. This allows the steam to enter the chamber *R* on the upper and larger surface of the differential piston *M*, which is thus forced down against the boiler pressure at *L*, and completely shuts the steam off from the pump. Should the hydraulic pressure fall below the desired amount, the diaphragm is forced down by the tension of the spring *B*, the auxiliary valve closes; no steam is admitted to the chamber *R*, and the piston *M* is forced open by the boiler pressure at *L*. The full head of steam is thus immediately given to the pump. The pressure can be instantly changed by the key at the top.



Mason Pressure Regulator.

Manufactured by the Mason Regulator Company, Boston, Mass.

Maritime Exhibition at Havre.

The following letter in regard to the International Maritime Exhibition, to be held at Havre next year, will interest many of our readers:

Editor American Machinist:

I have permitted myself to send you, under a separate cover, a circular from the managers of the International Maritime Exhibition, which is to be held here next year, to commence on the 1st of May, and to be continued up to the 30th of September or 15th of October.

This exhibition has the patronage of the French Government, and our Government at Washington has also countenanced it by replying in that sense to the application of the managers. I have proposed the appointment of an American commissioner, and look for a favorable answer.

The Havre Exhibition need not interfere with the American Exhibition, to be held simultaneously at London, as some of our American exhibitors may desire to be represented at both places.

The Havre direct steamship company offers to take any goods from New York for the exhibition at the usual rate of freight, and to return them there again gratis.

If you would kindly bring this exhibition to the notice of your numerous readers, you would much oblige the Havre authorities, and any further information which you may desire will be cheerfully given by this office.

Very respectfully yours,

F. F. Dufair,
U. S. Consul at Havre.

From the circular above noted, we learn that the exhibition will have three divisions. The second division, which will most interest our readers, is subdivided as follows:

1° Maritime steam engines or other mechanical engines.

2° Models and plans.

3° Special industries for fitting and storing ships.

4° Life-saving apparatus.

5° Fishing apparatus and material and products of agriculture.

6° Electrical engines.

All goods for exhibition must be received by the first of next April. Those proposing to exhibit from this country would do well to correspond with Consul Dufair.

The Curving Qualities of Locomotives with High and Low Centers of Gravity.

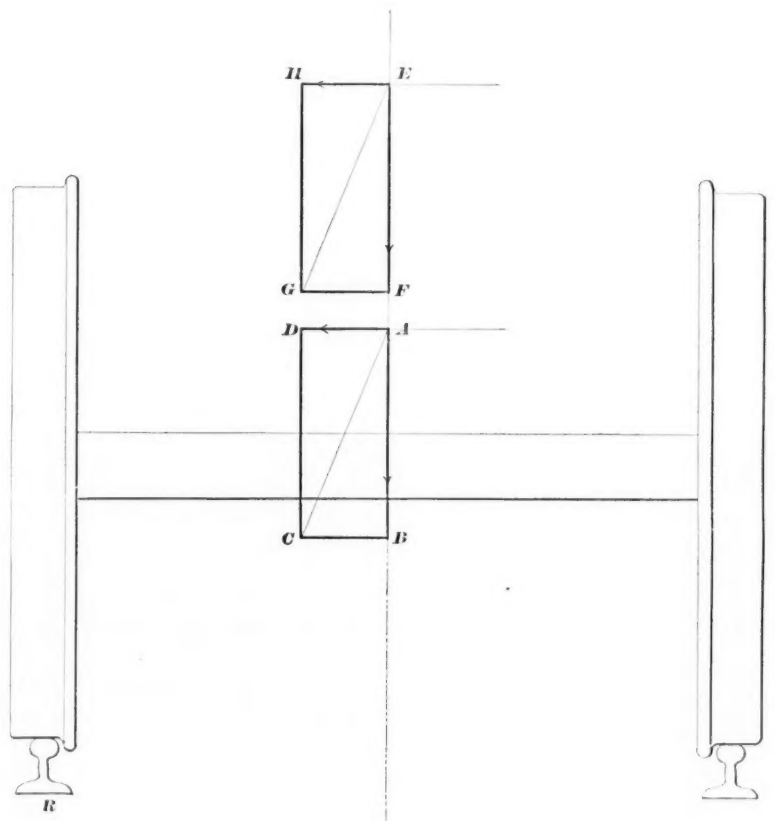
Let us first consider how much pressure there will be between the outer rail of a curved track and the flange of a rigid body moving along the curve. By "rigid body" we mean a body whose shape cannot be altered by any force, or forces, acting upon it, and that the body will either move or stand still, according to the action of the force or forces. Let *R*, in the annexed figure, be the outside rail of the curved track, and the point *A* the center of gravity of the rigid body. When this rigid body (throw all idea of wheels, springs, etc., aside) is passing over the curved track, two forces will act upon the point *A*, namely, one force will act downwards in the direction indicated by the line *A B* and arrow attached, and is equal to the force of gravity; the other force we may assume to act in a horizontal line, as indicated by the line *A D* and arrow attached, and is equal to the centrifugal force. Here, then, we have illustrated by straight lines and arrows the direction in which each force will act. In order to show the magnitude of these forces, it will be necessary to cut off each line to some particular length, and when this has been done, the forces will be represented complete. Thus, for instance, suppose that the weight of the rigid body is 20 tons, and $\frac{1}{8}$ of an inch is to represent one ton; then the length of the line *A B*, which represents the force of gravity, must be equal to $20 \times \frac{1}{8} = 2\frac{1}{2}$ inches; also suppose that the centrifugal force is equal to 5 tons; then the line *A D*, which represents this force, must be equal to $5 \times \frac{1}{8} = \frac{5}{8}$ of an inch. To the readers who are not acquainted with the method of representing forces by straight lines, we would say that the adoption of $\frac{1}{8}$ of an inch to represent one ton is simply a matter of choice or convenience; but when $\frac{1}{8}$ of an inch to represent one ton of one force has been adopted, then we must also use the same to represent one ton in the other force. We might have used $\frac{1}{4}$ of an inch, or $\frac{1}{2}$ of an inch, or any other measure, to represent one ton; but whatever measure we do adopt to represent a ton in one force, the same must be used in representing the magnitude of all the other forces. Now, having obtained the correct length of the line *A B*, and also that of the line *A D*, we complete the parallelogram *A B C D*, that is, through the end *D* of the line *A D* we draw a straight line parallel to *A B*; and through the end *B* of the line *A B* we draw a line parallel to *A D*, thus obtaining a parallelogram, which is called the parallelogram of forces; its diagonal *A C* is called the resultant of the two forces *A B* and *A D*. This resultant *A C* will represent the direction in which the point *A*—and consequently the rigid body—will move if not opposed by some other force or forces. But the rails prevent the force of gravity from moving the point *A* downwards, and the friction between the rails and the surfaces of contact of the rigid body will wholly, or to some extent, prevent the centrifugal force from moving the point *A* in the direction of the line *A D*.

If now, for the sake of clearness, we assume that there is no friction between the rails and the rigid body, then the centrifugal force will press the flange against the rail, and the resistance which the rail offers, or the magnitude of the force which opposes the centrifugal force, will equal that of the centrifugal force as represented by *A D*.

Again, let *E* represent the center of gravity of another rigid body of the same weight and moving over the curved track under like conditions as before, the only difference between the two bodies being that the center of gravity *E* of one body is considerably higher than the center of gravity *A* of the other body. Through *E* draw the vertical line *E F* to represent the force of gravity, and also through *E* draw the horizontal line *E H* to represent the centrifugal force. Let us also adopt as before $\frac{1}{8}$ of an inch to represent one ton; then, since the weights of the two bodies are alike, the force of gravity of one will be equal to that of the other; also, since both bodies move over the curved track under the same conditions, the centrifugal force of one must be equal to that of the other, hence, the line *E F* must be equal to *A B;* that is, it must be $2\frac{1}{2}$ inches long, and the length of *E H* must be equal to that of *A D*, namely, $\frac{5}{8}$ of an inch.

If again we assume that there is no friction between the rail and the rigid body, then the centrifugal force will press the flange against the rail, and the magnitude of the force which opposes the centrifugal force will be equal to that represented by the line *E H*. But *E H* is equal to *A D*, therefore the pressure between the rail and the rigid body whose center of gravity is high, will be equal to the pressure between the rail and a rigid body whose center of gravity is low. If now we take the friction into account, then, because both bodies are of the same weight, the amount of friction will be the same in each case, and consequently the amount of pressure against the rail will be reduced an equal amount in both cases.

In a rigid body the relative position of the centre of gravity cannot be changed, but in a locomotive, where nearly all the weight of the machinery is supported by springs, the center of gravity can, comparatively, be easily moved toward the outer rail when passing over a curved track; and it must be readily seen, that, when the center of gravity in a locomotive is high, the centrifugal force will have less resistance to overcome in moving the center of gravity towards the outer rail, than when the center of gravity is low.



Let us assume that the point *A* is the center of gravity of one locomotive, and the point *E* the center of gravity of another locomove. The weight of one is exactly equal to that of the other; in fact, both locomotives are exactly alike with the exception of the center of gravity, which is higher in one than in the other engine. When these locomotives run over a curved track at the same rate of speed, the centrifugal force of one will be equal to that of the other, also the center of gravity of both engines will be moved towards the outer rail by the action of the centrifugal forces, but the high center of gravity will be moved closer to the outer rail than the low one, because in the former the centrifugal force acts with a greater leverage. Again the closer that the center of gravity approaches the outer rail, the more the weight on the outer wheels will be increased. But as soon as the weight on the outer rail is increased the friction on this rail will also be increased, and therefore the force which tends to press the flange against the rail will be diminished by the resistance of the friction which it must first overcome, and thus the pressure between the rail and the flange will be reduced. From this we conclude that when the distance between the center of gravity and the rail is increased, the pressure between the flanges of the wheels and the outer rail will be decreased.

But here the thoughtful reader may ask: how is it, that, since the sum of the weights on both rails remains the same, and since the law of friction teaches us that the friction is proportional to the total weight, how is it that the friction can be increased without increasing the total weight? This law only holds true so long as the force which presses the two surfaces together does not cause abrasion. But as soon as pressure becomes so great as to cause abrasion, which will be the case in locomotives where more weight is thrown on one rail than on the other, the friction will be greater.

From the foregoing the reader must not be led to believe that it is advantageous to place the center of gravity in a locomotive as high as possible; it is always best to keep it as low as can be done particularly in fast running engines. The higher that the center of gravity in a locomotive is placed, the more liable will the engine be to upset.

The railroads of America comprise about one-half the total mileage of the world.

At a recent meeting of the Western Railway Club, in Chicago, some discussion was carried on regarding the rules for the interchange of cars adopted by the Master Car Builders' Association at their convention last summer. No conclusions were reached about changes, and it was voted to continue the subject at the next meeting. The following officers were elected for the ensuing year: W. A. Scott, president; H. L. Cooper, vice-president; Angus Sinclair, secretary; W. B. Snow, treasurer.

The *Morning News* (Savannah) has information of a gentleman of "a mechanical turn of mind," who has gone the entire length of perfecting an invention "for increasing the speed of railroad engines, which would enable them to draw a train of cars easily and safely at a speed of 100 miles an hour, and this speed could be increased to 120 miles an hour." We note the inventor is a man with a "mechancal turn of mind." These kind of men always find it much easier to do such a trifling thing as invent a train speed of 120 miles than experienced railroad men do. We haven't the remotest idea that any of the latter class will tackle the problems connected with that speed for a generation or two yet. In the meantime men with mechanical turn of minds will have the field all to themselves.

We might as well permit our enemies to direct the movement of our armies in time of war as to permit them to direct or control our manufactures and other industries in time of peace.—*Peter Cooper.*

The Baldwin Locomotive Works have recently built ten locomotives of new design for the Reading Railroad. They are described as follows:

"The new passenger locomotives are more powerful than any ever owned by the company. They are all supplied with the Wootten fire-box. A few slight changes have been made, the most notable in the fire-box. On all engines previously built the top of the fire-box sloped down toward the furnace door. In the new machines there is no slope, but the top is continued straight to the front of the fire-box. This secures a rather larger heating area, and consequently increases the power. The new engines have been tried and give perfect satisfaction. It is said they can run a mile in 42 seconds with a loaded train. It is believed, should an emergency require it, a mile could be made in 40 seconds or perhaps a little less. There is no probability that such speed will be required. Two of them are now working on the Philadelphia and Atlantic City road, which at one time was very deficient in good motive-power. Six or eight cars were the maximum an engine could haul and make schedule time, but the new locomotives can take 18 cars through on time. The other engines are engaged on the main line, the Lebanon Valley and other divisions."

According to the *Army and Navy Journal*, there is but little disposition among American shipbuilders to bid for the construction of the new vessels of war authorized by the Navy Department. The officials of that department are afraid that no bids will be submitted. It is said that no firm is able to complete the vessels in the time officially advertised. "Mr. Roach's late experience with the department has certainly not been such as to encourage shipbuilders to compete with him for its favors, especially as considerable trouble would likely be experienced in getting bondsmen."

One of the most remarkable failures we have ever noticed is that of the new vessel of the English navy, the Plyades. Her trial trip came to an abrupt termination, it is said through the failure of her safety valves. The conclusion in this country would be, from such a report, that there was an "African in the fence."

Railway employes have occasion to feel great interest in the rapid progress of railway construction. As we have before stated, taking the present average for the United States, every new mile of railway calls for the employment of five more men. Up to the present date nearly 4,000 miles have been laid in 1886, which means that permanent employment has been furnished this year to something like 20,000 additional men. Of course experienced railway men have the preference, and so every mile of new track tends to furnish more opportunities for those already in the service, and also to give them better prospect of promotion. We estimate that the employes of the railroads in the United States already number not less than 650,000 men, a great and powerful army which is constantly increasing in numbers and influence. How vastly important for the interests of the whole country as well as of the railways it is that these men be educated to integrity, sobriety, efficiency and justice toward themselves and others. Much is being done by railway companies for the intellectual and moral improvement of their employes, but very much more ought to be done, through libraries, reading rooms, the circulation of safe and instructive periodicals, and other means. If every railway company would place the right sort of literature in the hands of every one of its men who can read, the cost would be returned a hundred fold. Ignorance and prejudice are the chief elements which employers of labor have to fear.—*The Railway Age.*

Lathe Center Grinder.

This machine appears to possess several good features of construction that adapt it to satisfactorily do the work for which it is made. First it is operated by broad, flat belts that run on pulleys having parallel axes. This gives ample driving capacity under all circumstances, without tendency of belts to run off, as when twisted.

The machine has three adjustments, viz.: vertical, horizontal and angular, each of which can be made almost instantly. The vertical adjustment enables the machine to be used on various sizes of lathes, and the horizontal adjustment enables long or short centers to be ground with equal facility. The angular adjustment admits of grinding angles greater or less than the standard, 60°, which is indicated on the machine.

Emery wheels one-half inch thick are used and are counterbored for the nut so that the wheel may grind close to a face plate on short centers. The emery wheel spindle is of steel and has tapered journals with end adjustment for wear. It is mounted on a dovetailed gibbed slide, and is operated by a quick working lever. The pulleys on these machines are all held by feather keys.

The machine is driven by means of a belt from the lathe face plate, except on lathes of large size, when a special driving pulley is furnished to be doweled and bolted to the face plate. One belt and a suitable emery wheel are furnished with each machine.

These machines are manufactured by O. S. Walker, Watertown, N. Y. The Machinists Supply Company, 216 Lake street, Chicago, are Western agents.

The *Railway Review* (London) says:

Another case of a runaway train is reported this week. It appears that two carriages which had been detached at Brockholes Junction, on the Lancashire and Yorkshire Railway, ran down the line on the facing road for a considerable distance, and were eventually turned into a siding by a signalman. The consequences of such an accident as this, and the similar one which occurred at Penistone a few days ago, are of the utmost danger, and it is almost a miracle that nothing more serious occurred in either of the two cases referred to. In neither case were the vehicles fitted with an efficient automatic brake. If they had been so fitted the carriages would have been held by its power.

Fires Due to Dirt.

The Fireman's Herald says: "One who has been there says that when he goes through the manufacturing establishments of the country and sees the careless, not to say filthy condition in which most of them are kept, he is never surprised at hearing of one burning. His surprise is rather that they do not all burn. And one might class village stores and workshops in the same category. There is hardly a store or shop of any description in the smaller towns that has not either an unsafe flue or stove or stove-pipe, or a pile of old boxes and rubbish, including straw and waste paper, intermingled with wooden ash-boxes in the rear or adjoining. Fires get started in these places, and as the rubbish extends in the rear yards from street to street, the whole block is burned out. The man who could impress upon the average manufacturer and the country storekeeper and mechanic that cleanliness was akin to godliness would be a true and most valuable missionary. We might make the addenda that these remarks are applicable to cities as well as to towns and villages."

In a paper on recent improvements in the manufacture of rifle barrels, read by Mr. Arthur Greenwood at the meeting of the British Association, be said: The introduction of steel rifle barrels some 25 years ago, and the gradual substitution of that material in place of welded wrought iron for the barrels of military rifles and arms of precision, has caused great changes in the machinery employed in their manufacture. The barrels generally used for military rifles are made from mild steel rolled solid and the bore drilled out. This is necessarily a costly operation, and numerous attempts have been made at hollow rolling to avoid expense of drilling. To effect this, barrel "blanks" or short pieces of steel have been drilled and afterwards rolled on a mandril to the desired length, and many thousands of barrels have been made on this plan. Of late years, however, the military authorities have insisted upon barrels being first rolled solid to the desired form and afterwards drilled. At the Royal Small Arms Factory at Enfield a system of continuous rolling has been established, whereby the barrel has been rolled to its exterior form at one heat by passing it through a number of rolls placed one after the other. A barrel is thus rolled in about half a minute, which gives a great saving in time and cost of production, and the material is not harmed by reheating, as was often the case in the old system. When the rolled barrel has become cold it is passed through a straightening machine, which takes out any short bends or "kinks," and is thus made ready for drilling. Before going to the drilling machine the barrel goes to a machine which faces or squares up the ends, and prepares a bearing at each end of it upon which it will rotate in the barrel-drilling machine. The barrel-drilling machine has been specially designed to drill a perfectly true hole through the barrel, and to avoid straightening by means of external hammering, which is extremely harmful to the barrel. Three barrels are operated upon at one time and drilled simultaneously from both ends. The machine is horizontal, and the barrels rotate at from 700 to 900 revolutions per minute. The drills are of the form technically known as D, or half-round bits, and are fed up automatically, a heavy pressure of water being injected up the barrels so as effectually to wash out the cuttings or "swarth," and thus insure the free action of the drills. About 30 barrels can thus be drilled in the working day by one attendant. This system reduces the cost of drilling to little more than an eighth of the former system employed at Enfield, the results as regards excellence of work being at least equally good. The barrels are then rough or quick-bored, and then "spilled up" or fine-bored in horizontal machines by means of square bits; this system is well known and has undergone little change during recent years. The exterior of the barrel is next turned, and ingenious arrangements have been made to secure the exterior being turned true or concentric with the bore.

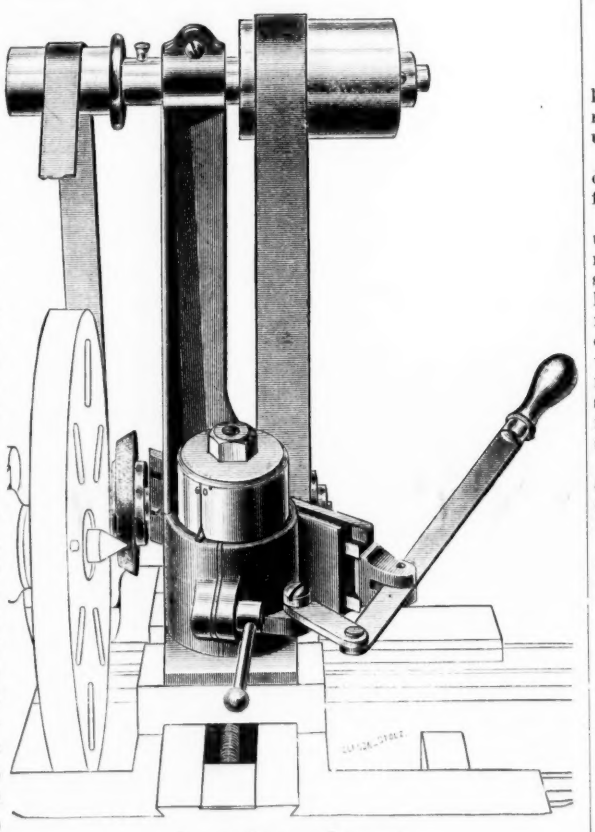
Starting Right in Building Works.

The importance of starting right when designing and laying out a manufacturing plant cannot be over-estimated. One of the most important things to be considered is the possibility of future additions to the buildings and machinery which may be demanded by an increasing business; yet how often is this overlooked. It is nearly always just as easy when locating buildings, to so place them that they may be added to at any future time without tearing down some other building or removing a large amount of machinery, as it is to huddle them all together so that there is no chance for expansion without remodeling the whole plant, or stopping some portion or a whole of the works for a longer or shorter time. Such additions to a plant are generally made when business is rushing, and the concern can least afford to stop.

Especially is this true with respect to the motive-power of a manufactory. Upon this depends primarily the running of the works, and it is of the utmost importance that boilers and engines should be so placed that their capacity may be doubled or trebled without interfering with the running of the works. The boiler-room is especially apt to be slighted in planning the works. This arises generally from the mistaken idea that any place that a boiler can be gotten into is a good enough place in which to set it up and run it. When the works expand the mistake is generally felt, but many times the conditions are not improved. In consequence, there will be found to-day a great many concerns, comparatively small, with two or three separate boiler-rooms; some have one boiler-room, some two, and perhaps another with some other number of boilers. The running of two or three separate boiler-rooms, when all might be consolidated into one, is a very expensive and unsatisfactory way of making steam.—*The Locomotive.*

Patagonia will soon have its first railway at the Welsh colony of Chubut, a vessel having left England with permanent way.

News of striking wells of natural gas comes from near Albany, N. Y., from near Des Moines, Ia., and from Akron, Colorado. Possibly the excavations for the new Croton Aqueduct may discover natural gas in this city.



Lathe Center Grinder.

Railway Master Mechanics' Association Matters.

Of the following circular letters the first has reference to the action taken at the Boston meeting; the second is for replies to be embodied in the committee's report at the next meeting.

American Railway Master Mechanics' Association.

Office of the Secretary.

J. H. Setchel, Secretary. William Woodcock, President.

Dunkirk, September 15th, 1886.

Dear Sir: At the annual meeting of the American Railway Master Mechanics' Association, held in Boston, in June, 1886, the report of the Committee on Standard Diameters of Driving Wheel Centers was unanimously adopted.

The sizes proposed by the committe and adopted by the association, are as follows: 38 in., 44 in., 50 in., 56 in., 62 in. and 66 in.

The committee was instructed to make arrangements with the Pratt & Whitney Company, or some other reputable firm, to make and furnish the railroad companies, locomotive builders and tire manufacturers, standard gauges representing the various sizes adopted, both for the outside diameter of wheel center and for the inside diameter of tire, for each size as given above.

The committee have made such arrangement with the Pratt & Whitney Company, of Hartford, Conn., who are now prepared to enter orders for these gauges, made in accordance with plans submitted to, and approved by, the committee, and will furnish them either in sets comprising the six sizes adopted, or in pairs, separately, at the following prices, which are net, delivered on board at Hartford, quotations subject to orders being received on or before October 15th, 1886:

Set of six pairs standard reference gauges, for outside and inside measurement, complete in finished cherry cases, with lock, $105. For parts of set, in pairs, or for single pair, $26 per pair. Cherry cases for parts of set, $5 to $7.50 extra.

As it is desirable to have the new system embodying this standard of uniformity introduced at as early a date as possible, and in order to take advantage of the exceptionally low prices offered, orders should be placed with the Pratt & Whitney Company, on or before October 15th, 1886.

The sizes represented for inside diameter of tire, or each of the six gauges in the full set, are as follows:

38 inch, less	0.040 inch,	37.960 inch.
44 inch, less	0.047 inch,	43 953 inch.
50 inch, less	0.053 inch,	49.947 inch.
56 inch, less	0.060 inch,	55.940 inch.
63 inch, less	0.066 inch,	61.934 inch.
66 inch, less	0.070 inch,	65.930 inch.

J. N. Lauder, Jacob Johann, H. N. Sprague, Committee.
J. H. Setchel, Secretary

American Railway Master Mechanics' Association.

Office of the Secretary.

J. H. Setchel, Secretary.

Dunkirk, Sept. 15th, 1886.

Coal Delivery to Locomotive Tenders.

1. Describe the various systems of delivering coal to tenders that you use. If any machinery, staging or special equipment is used, send "blue print" of same.

2. Say why different systems are used at different stations, specifying which you prefer, and giving reasons for preference.

3. Give average cost of delivery per ton under each system, so that comparison may be made of value and thoroughly understood. State the average number of tons delivered each 24 hours, the number of men required in the 24 hours and the average rate of pay per 12 hours for unskilled labor. (It would make this comparison more interesting if, when a special plant such as crane, shutes, staging, etc., is used, its first cost and maximum capacity of delivery per 24 hours were stated.

4. Describe any special conveniences you are familiar with for coaling the bunkers of switching, tanks and other engines not provided with tender.

N. B.—Replies will be treated as referring to soft coal and the short ton of 2,000 lbs., unless it is otherwise stated.

Jas. Strode, N. C. R.,
Chas. Graham, D. L. & W.,
J. Davis Barnett, G. T. R.,
Committee.

Replies to be addressed to
J. Davis Barnett,
Port Hope,
Ontario,
Canada.

U. S. Consul Campbell, writing to the State Department from Monterey, Mexico, says:

"On some of the large haciendas in this vicinity, notably that of Bella Vista, belonging to General Trevino, and on the hacienda belonging to Senor La Grange, American agricultural machinery is more or less used. Subsoil plows, cultivators, and mowing, reaping, and threshing machines are to be found in some localities. Here and there a windmill is seen, and in many ways the Mexican farmer is realizing that he is far behind the age and laudably endeavoring to bring into use more improved methods of cultivating the ground than he is accustomed to. The cheapness of manual labor, however, combined with the enormous cost attendant upon the introduction of improved machinery, is a serious drawback to him. Besides these hindrances, should any part of his costly and unfamiliar machine break, it must, in nearly every case, be thrown aside for that season. No Mexican blacksmith can repair it, as usually the broken part is of cast-iron; and the distance from the manufactory precludes the obtaining of a new piece before another season."

The latest thing in house decorations is a little slate. Upon this callers who are without cards inscribe their names.—*Journal.*

Good gracious! We always thought the little slate was a saloon decoration, whereon the names of callers who were without stamps were recorded.—*Boston Bulletin.*

There was a very decided falling off in the output of new ship-building on the Clyde during August, while in this country there has been an improvement.

The following table will show the tonnages on the Clyde in July and in the past eight months, as against the output in the same periods during the preceding ten years:

	August.	Eight Months ending August.
1876	21,400	174,284
1877	11,300	167,710
1878	23,932	222,353
1879	10,000	174,750
1880	17,982	241,114
1881	30,000	341,022
1882	27,940	391,934
1883	34,032	419,664
1884	25,762	296,854
1885	13,693	187,508
1886	10,121	112,495

A prohibition candidate is heavily handicapped. He may be making a telling speech to a good audience, and yet any short-haired citizen could break up his ward meeting by shouting: "Say, boys, Skinny Wilson is settin' 'em up at de corner grocery!"

It is officially stated at the office of the Pennsylvania Railroad Company, at Pittsburgh, that the introduction of natural gas into that city has displaced at least 1,000 cars of coal fuel which was consumed daily.

Col. Robert Ingersoll, in arguing a case in court against the Western Union Telegraph Co. (which he won) said: "People are afraid of a mob. All honest people stand between two dangers—the mob on the one side, and aggregated capital, incorporated rascality, on the other. I am as afraid of one as of the other. I am fully as much afraid of the millionaires as I am of the mob. Honest people will stand between them both."

At this writing a first class conundrum is: Who invented the telephone? It is an old query, but develops new interest every day or two.

Ruthenburg's Chemical Engine.

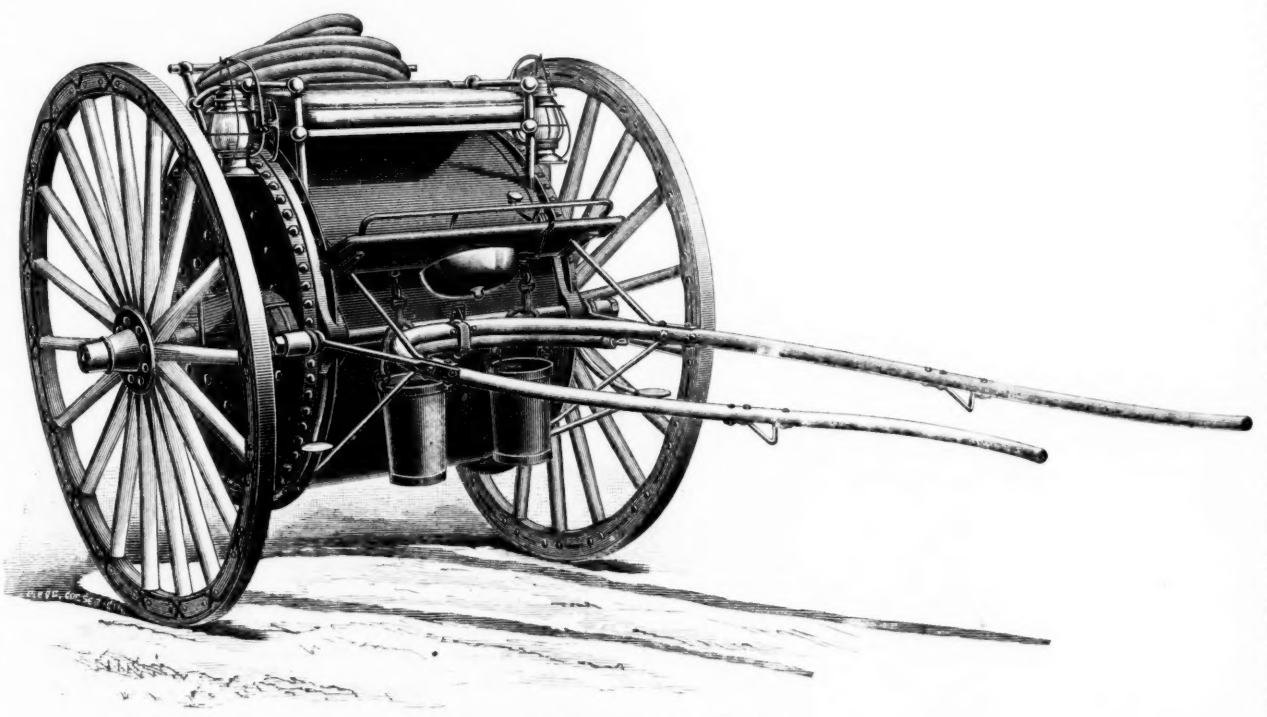
The use of chemical engines for extinguishing fires in towns and villages and isolated localities, and to some extent in large cities, is common.

The engraving shows one of the latest of such engines made by the Ruthenburg Automatic Fire Extinguishing Co., Cincinnati, Ohio. Some of the advantages claimed for this engine are that it is under pressure all the time, the pressure being indicated by a gauge, which at all times gives evidence of the condition of the apparatus. All that is necessary to use the machine is to open a valve and handle the hose. In charging, the chemicals are mixed in a cask, and forced in with a pump. The solution used will not freeze, will not corrode metal, nor injure any fabrics.

The machines are made in different sizes, and are somewhat differently arranged for different purposes.

It is expected that the extension of the Canadian Pacific Railway to Sault St. Marie will be completed during the next twelve months.

An artesian well in Pesth, Austria, having a depth of 3,120 feet, furnishes water of a temperature of 158°. If the boring were continued to a sufficient depth they might have steam on tap.



Ruthenburg's Chemical Engine.

LETTERS FROM PRACTICAL MEN.

About Cutting Tools—Roll Turning.

Editor American Machinist:

After reading the paper by Mr. Hobart on "Power Absorbed in Cutting Cast Iron," I feel like suggesting a vote of thanks to the parties who have gathered up all these "chatters, slight and bad, and tremendous," and given us the whys, and becauses, and preventions. Of course the old-fashioned method of forging, and grinding, and setting lathe tools by guess will continue. But if the tool-dresser who will give every tool susceptible of it a great amount of clearance, and the machinists who will snub tools off in grinding, because a few seconds of time can be saved in grinding each tool, will only read a little ways into the second paper, in issue of September 18th, they will learn something to their advantage. Who of us but has had the very foundation of his nervous system stirred by the chatter of a diamond-point tool which the tool-dresser would insist upon forging with its cutting point poked out as far as an angle of 45 degrees would carry it, and to clap the climax, knocked the point of the tool over sideways half as much, which way it was knocked depending upon whether it was to cut to right or left? You know about it? Of course you do. You have redo. In fact, without them, or without any other printed information, he has all through his years of practice, since he began to think, found himself daily wishing that he could have things just as he wanted them, so that the chattering, rough working, scraping and tearing tools could be made to cut smoothly and easily. He would have his tools forged right if he could, but he has to take what he can get. He would have a lathe, if he could, with such facilities for setting tools as to permit always the right position, but he has to use such as his employer furnishes. If a machinist's setting of tools sometimes includes letting the blade of a tool stand out a long ways beyond the tool post, and blocking up under the back end to get the point low enough to clear, and so instead of cutting off the stock, mauling it off, it does not follow that he does it from choice, or because he knows no better. There is the tool, there is the lathe. He sees no alternative. He does the best he can under the circumstances. And so a tool which might be a model of perfection in its line, if used in a lathe with sufficient range of tool post adjustment to permit it to be set properly, becomes the most abominable thing imaginable.

"Much ado about nothing," does somebody say? Don't you believe it There is millions of waste in wrong angles, *per se*, in all the fine points contained in the column or more devoted to the test of side tools, set or ground, at different angles, I wish to ask a question or two. Did the tool which broke and wore off at the point, necessitating numerous trips to the grindstone, behave thus badly, simply because it had been ground to several degrees above the axis of the tool? Did the tool which had been ground down to bring the line of cut 5 degrees below the axis of the tool stand to do lots of work without requiring much grinding, simply because of change of angle? Would the depression of the point of tool in one case, to present the most faultless cutting angle, have saved it from breaking, or wearing off at the point? or, would the elevation of the point of the half worn out tool to the faulty cutting angle have caused it to break and wear off? No. What then? The point of the tool which breaks, and breaks, and finally stands when the successive grindings have shortened the tool at the point, and carried the cutting edge down anywhere from $\frac{1}{8}''$ to $\frac{1}{4}''$ or more, would be likely to act the same way to a greater or less degree anyhow, no matter at what angle it was ground or set. That part which breaks, and crumbles off, is in condition to do just that. It bears about the same relation to the true condition for cutting tools of the steel beneath, or within it, that the bark and sappy portions of wood bear to the solid stuff beneath. Is it common custom for tools to act this way? In some shops, yes, and it is not confined to side tools, but all sorts of lathe and planer tools, drills, taps, reamers, in fact anything in shape of steel hardened shows this same tendency to break. Is it necessarily so? Not at all. A little common sense reasoning, and a more intelligent treatment of the matter, should result in having tools prove just as good at the first point, or edge—just where they should be the best—as at any part further in, to be reached by successive breaking and grinding off. It depends mainly upon the question of hardening at the proper heat, this being, notwithstanding the worse treatment which the thinner parts monstrated with the tool-dresser, and had him fire this question at you, with all the spitefulness of injured innocence: "A tool has to have clearance, don't it?"

As I, being one of the older lathe hands, used to guess at these things, and have worked alongside of a great many pretty good men who also guessed, and who guessed pretty close, too, it occurs to me that a little idea like this once getting fixed in a lathe-man's head will come handy: There must be clearance enough for the cut to be taken, and to allow for the drilling and rounding of the edge of the tool; but, beyond this, clearance is many times a great injury. In no other direction in the machinists' practice does the truth that one can have "too much of a good thing" come home with more force. Each degree of clearance added, beyond what is necessary, works disadvantageously in more ways than one. It throws the strain of cutting out of the line best calculated to take it without a tendency to chatter. It diminishes the possibility of grinding at the top to the most desirable cutting angle without weakening the edge too much. Yes, there is in these tables matter for hours of careful reading and weeks of profound thought, and still as the average lathe hand continues in his daily round of squaring up, roughing out, turning to size and finish, etc., etc., he will be all the time to some extent hedged in by sundry and divers conditions, and surroundings which interfere with his doing what the Hobart papers teach him that he should cutting tools, and possibly more, in how tools are set. If to strive to save 10 per cent of the coal burned, from which power is derived, is looked upon as a show of good sense, is not the saving of from 10 per cent. to 50 per cent. of the power used to do a given amount of cutting on lathe or planer of still a greater importance?

Keeping on the side of the question on which my old-fashioned by-guess education naturally places me—for however much I may admire new methods, and however strongly I may put my congratulations of the boys on their greater advantages and consequent acquirements than existed, or were possible, in my younger days through which I am satisfied that I am being left behind—I feel disposed to try to wedge in some old-fashioned notions on this cutting subject.

First, suppose an attempt is made to get at the real pith of the difference between a "side tool about half worn out, the line of cut 5 degrees below the axis of the tool," one of the "ground in a hurry" sort, and "a new side tool ground rapidly up to several degrees above the axis of the tool." Of this last described tool is said, "never stands long in a cut. It soon breaks, or wears off at the point, and makes numerous trips to the grindstone." Of the tool described first, the apparently snubbed off, ground in a hurry, ill shapen, half worn out sort, is said, "it seems to do lots of work without grinding." Sticking a pin here, without trying to wade through, and extract all the information, and elucidate may get previous to hardening, really the key to the situation. The trouble is, that the thinner, lighter part at the edge or point, which should have the greatest care taken that they be not heated for hardening above a certain heat, are often too hot, if the thicker, heavier portions are hot enough; in fact, the natural tendency in heating a piece of steel for hardening which is thinner in some parts than others is to heat the part which needs, and must have, to be right, the least heat, the hottest. Clearance angles, and cutting angles, and setting, may be perfect, but, when a tool is hardened with its cutting point or edge too hot it is liable to crumble regardless of how it is ground or set.

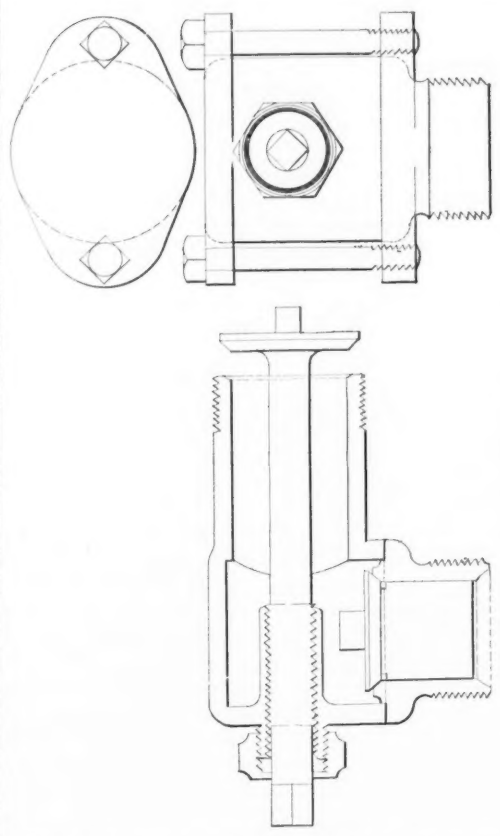
How a tool shall be ground and set, what are the proper angles of clearance and shear, vary so much with difference in material, different cuts, etc., that it must necessarily be left largely to "the men on the spot," to decide each one for himself these questions; but, however well they decide, or however accurately the dynamometer may indicate what is most desirable, there must be that integrity of point and edge which will stand heavy strain without breaking, and do much cutting without becomming dull, if best results are to be reached.

The tool with much shear, and thin edge whetted up to almost razor sharpness, which cuts soft stock smoothly and easily, is to be admired in its effectiveness when confined to working on material to which it is adapted, but set it to turn something hard and any boy knows

"it don't amount to shucks." By the way, who has ever seen a letter in the American Machinist on roll turning? Cannot some roll turner be induced, persuaded, or provoked into telling us all about the operation. I mean the turning of cast-iron chilled rolls. I never turned one. What is wanted is what somebody knows, not what I don't know. Still, as I have seen some roll turning done incidentally, I don't mind, just to break the ice, telling how it looked to me. Of course there are plain cylindrical rolls, and rolls that are grooved in all the variety of shapes called for by the shape of material to be produced by them.

First, the lathe. It don't look much like an engine lathe. The roll to be turned, having had its journals first turned, is run in boxes secured in ponderous and unyielding housings. Lathe centers would not stand the strain. Now, with the roll running by its journals in bearings as rigid as will carry it in actual use, the turning may begin. No use here for diamond points, round-noses, duck-bills, or any others of the tools that are fed continuous chip as in turning shafting. No along the length of the roll and take off a tool-post through which to poke a piece of steel to be held in place by a set-screw and do the cutting with its front end, but on the great carriage a cross-sliding solid block on which to lay the tool and clamp it down solid as the hills. What kind of tool? That depends upon what kind of turning. For plain cylindrical turning the tool may be flat steel, or square steel; simply a piece as long as it is thought desirable to use. The cutting is done by the corner. The tool, sometimes several inches in length—length being estimated lengthwise of the roll—is fed at intervals toward the axis of the roll and removes a succession of needle-like chips from the hardened cast-iron, nearly as hard as hardened steel. Thus a section of the roll as long as the tool, is turned to size required, and the tool being moved forward its length the operation is repeated successively until the job is complete. The speed must be very slow. The tool must be extremely hard, and must be hardened at a heat which precludes a weak, brittle condition, for the temper is undrawn. To facilitate grinding, the tools are sometimes made with a chamber, or concavity along each face, parallel with the cutting corners, thereby removing much of the stock which would otherwise have to be ground off to get up to a sharp 90 degree corner. For semi-circular grooves round square-ended plugs, any part of the corners of either end of which constitute the cutting edge are used. For other shaped grooves, tools of such shape as indicated, are used, always following up the same general practice described. This refers to cylindrical turning, plain or grooved, but there is much turning of chilled rolls in which great ingenuity is required to produce in the extremely hard metal such eccentric or irregular forms as will turn out the blanks required. For instance, the faces of a pair of plain cylindrical rolls may be divided through their entire length into such circumferential sections as their diameter will permit, and by a process of eccentric turning, by an ingeniously devised arrangement for advancing and retracting the tool, there may be a series of dies turned, say for rolling blanks for table knives or similar work. These dies, turned in the face of the rolls, may be used on the plan called back-rolling, with a suitable feed timed to introduce the work at just the proper time in the revolution of the rolls, with great economy in the lengthwise tapering, and edgewise thinning down of table knives. One pair of rolls furnish a great number of dies, so that the life of the rolls is a long one. A good plan is to use steel wide enough for two blades with their backs in the center. This gives a piece to roll in which there is no tendency to crowd to one side, both sides being alike, more blades can be rolled in a given time, and the cutting out of the blades from the rolled blank with punch and die in a press is a small matter. Much work which is ordinarily done by plating under a hammer, by swaging, or other methods, even by grinding, can be done in rolls, if only the outlay is made to provide means for forming dies on otherwise cylindrical surfaces.

S. W. Goodyear.



Locomotive Check Valve.

Editor American Machinist:

The sketch shows, half size, a locomotive check which I designed six or seven years ago, and which has continued to give excellent satisfaction. I was moved to make this check from seeing the need of getting at the check valve with steam on the boiler. An engineer will come in and report a check as leaking. The engine is wanted; no time to blow off and fix it, so he gets the privilege of using it in that condition, perhaps for weeks, all the time having a hot injector to contend with. No one but the engineer knows the misery of a leaky check.

In ordinary check valves the seat is in the shell, and has to be milled out to repair; it wears away very fast. In repairing you have to scrape the valve and make numerous journeys to the engine to get it fitted. In this the seat answers for the cap, and when it is off you can take it to the shop and repair it, or renew it if worn too much to be satisfactorily repaired.

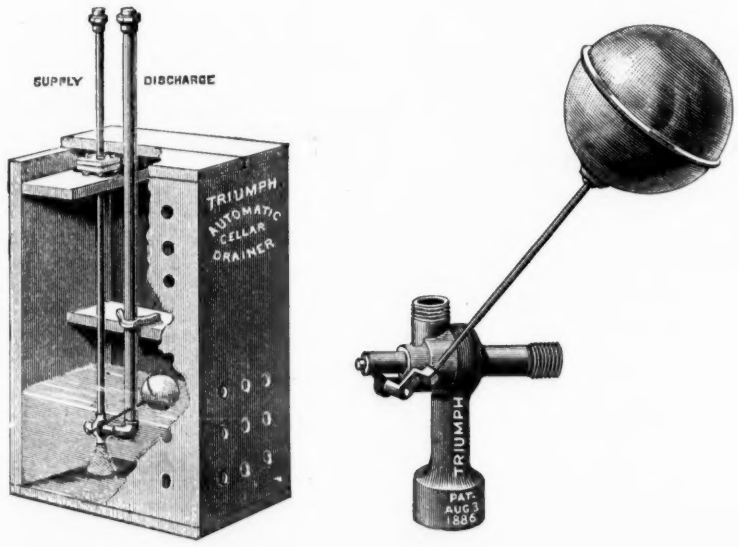
The seat and shell are held together with bolts. When screwed together in the ordinary way they come apart hard, and the thread in boiler sheet is not infrequently set leaking in the effort to start them. The bolts are where they can be readily come at, and being tapped in brass will start without breaking.

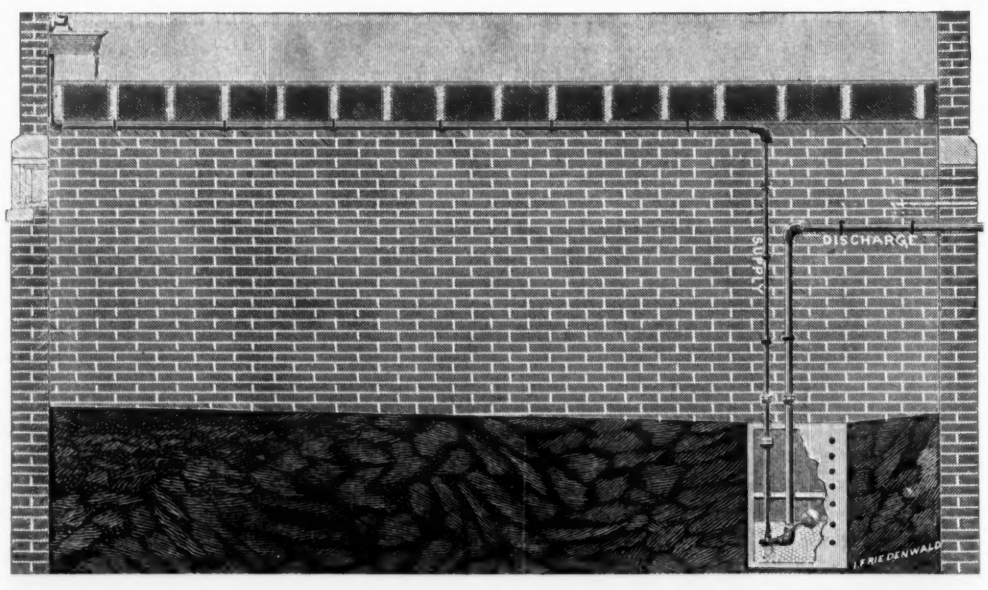
The shut-off seat is narrow, and designed to avoid catching dirt, also to crack off the scale that will collect on the valve, which is of course used only when shutting off for repairs. The thread on the stem does not extend into the shell, in which case there would very likely be trouble with hard mud and scale that would collect on it.

In most cases a check valve is troubled by hard scale getting under it, and if relieved at once will generally be all right. As this check can be relieved of whatever is troubling it in a few minutes, with steam on and without breaking troublesome joints, there is no excuse for leaving it in a leaky condition

Made with plenty of material—heavy—this check will, I know from experience, give satisfaction. It does not look quite so neat as one without bolts, but it can be encased so as to do away with any objections on that score.

W. H. Bradt.





Automatic Cellar Drainer.

Automatic Cellar Drainer.

The engravings represent a device for automatically draining cellars, excavations cesspools, pits, etc. The machine is operated entirely by water pressure, and requires no attention after being once properly arranged. It can be used anywhere where there is water pressure, as from the pipes used for water service in cities and towns.

To place the machine, a box with the sides made of slats is sunk in the lowest part of the cellar or other place to be drained. A half-inch pipe leads to the service pipe and is connected to the drainer, which is placed in the box. A one-inch pipe is connected with the discharge end of the drainer, and leads to the gutter, or wherever it is desirable to discharge the water.

The float shown operates to open the valve in the supply pipe when the water accummulates in the box, and closes it when the water has been discharged thus automatically keeping the water at a certain height in the box.

A. Aller, 109 Liberty street, New York, sells these machines.

Mitis Wrought Iron Castings.

We have received from W. F. Durfee, general manager of the United States Mitis Company, New York, an interesting specimen of Mitis wrought iron casting, accompanied with the following letter, which is too good to be omitted:

Editor American Machinist:

I herewith present you a sample casting made from melted wrought iron, which shows what is possible by the Mitis process. The article was designed for a "beefsteak pounder," but it can be applied with success to a variety of purposes. Its general appearance will at once suggest its employment as a hair brush, in which service it will doubtless stimulate an extraordinary activity in the brain of the party under treatment. Therefore, paraphrasing the ancient use of the razor strop man: "If you have an assistant remarkably dull, just rub this brush upon his skull." If this does not answer, reverse the implement and make a vigorous percussive application to the (in reversed) most obtrusive part of his person. This I am sure will convince the most obdurate mind that might is (Mitis) right, and that such "reverses" are favorable neither in the breach nor in the observance.

We feel impelled to add to this a little matter descriptive of the casting with which Mr. Durfee favors us:

The base of the casting is a rectangular plate 3 by 4 inches, by $\frac{1}{4}$ inch thick, with a handle. From this plate project 96 parts, one inch long by about $\frac{1}{4}$ inch by $\frac{1}{16}$ inch. In casting it was necessary to vent these projecting parts, for which purpose a vent rod, apparently of about $\frac{1}{16}$ inch diameter, was used, through about $\frac{7}{8}$ inch of sand. Now one of the peculiarities of this casting is that the metal not only filled the projecting parts, but flowed up and filled the holes in the sand, left by the vent wire. We have no doubt that this peculiar condition is what suggests to Mr. Durfee that it would make a good hair brush. It certainly shows a most remarkable fluidity of metal. We may remark, as emphasizing this, that while these projections of metal in the holes left by the vent rod show a strong resistance to bending, they will yet bend double without breaking.

Improving Machinery.

A great deal of the deprecatory talk about manufacturers who change, in some way, the quality of their products at frequent intervals, is sheer nonsense. This is particularly true in relation to machine-shop products. Standing still, so far as improvement is concerned, in the machine business means, rela-

tively, going rapidly to the rear. An excellent tool or machine may be brought out—something materially superior to anything of the kind in the market—and for this reason sales may be all that could be desired. Now it would be very satisfactory if there could be a certainty of building this tool or machine, just as it is, and holding the trade. But there is no such certainty, or even probability. The very excellence of the product is against this. It stands as a high-grade pattern for other sharp manufacturers in similar business to improve upon. In order that others may not get ahead, it is necessary for the manufacturer of that tool or machine to study it as sharply as his competitors will do in the way of improvement.

Not infrequently the assumption of the builder is that there will be time enough to remedy defects in his machine when some one else has made it better than he has. This is generally bad policy. The trade will be likely to go to the one who has first comprehended and put in practice needed improvements.

It is not difficult to find shops that a few years ago were at the head of the trade in their lines, but which are now losing money every year. They made the best in their line twenty years ago, and have stuck to that "best" ever since, while others have taken all that was good in their ideas and improved upon it. To paraphrase the old adage: Eternal progress is the price of successfully building machines and machinery.

The first iron vessel built on the Delaware River, the steamship J. W. Everman, formerly the J. Betts, which for years has run on the Clyde Steamship Line between Philadelphia and southern seaports, has been sold to Philadelphia parties, and will be converted into a coal barge.—*Nautical Gazette.*

The law says telegraph poles must come down in New York and Brooklyn and that the wires must be placed underground. It expressly forbids the erecting of any more poles. This trifling matter does not seem to worry the Western Union Telegraph Company. It has strung its wires upon the elevated railroad structure in New York, and is erecting a new line in Brooklyn, using the largest kind of poles. Nor is there any probability that the officials of that wealthy company will be punished for their open defiance of law. Meanwhile it has been conclusively proved that it is not safe to boycott a lager beer saloon. Parties engaged in such a nefarious undertaking are likely to find themselves on the way to Sing Sing before they have time to comprehend the nature of their prosecution.

A correspondent in Ohio writes about a process of making shafting by cold drawing which has been in use about three years. He says: "I presume it is not generally known," but as he does not name the location where it is running, and does not wish to have his own name published, it may remain unknown indefinitely so far as he is concerned. He writes that the daily output of a single machine on double turn is 10,000 feet in twenty hours, of all sizes from $\frac{1}{4}''$ to 5" diameter.

Car builders are pressed with orders and many of them refuse to contract to fill any new orders this year. Some of the most important railroads, notably the Pennsylvania, are short of freight cars. Orders are also increasing at locomotive shops.

A syndicate has made a proposition to Philadelphia Councils, offering to lease the gas-works for a term of years, paying a yearly rental of $1,000,000, and reducing the price of gas to consumers by $200,000 a year. They promise to spend $3,000,000 within five years in improvements. If this scheme is carried out, the next step will probably be to lease the city water works to some private company. There is no more reason why a private company should control a city's gas works than its water works.

The old steamboat Plymouth Rock is to be broken up. She was built in 1854, and for the past few years was used as an excursion boat.

A mercantile exchange has been organized in Kansas City, "to encourage well-directed enterprise; to promote the progress, extension and increase of the trade of this city, and make it better known as a manufacturing and commercial center."

Condition of Leading Industries.

There have been various interviews with business men published in the daily papers giving their views as to the condition of trade. We believe that the actual condition of each trade can best be learned by reading the regular periodical review in the representative newspaper of that trade. We have, therefore, selected from leading trade journals a portion of their recent market reviews, which we publish herewith.

Crockery and Glassware.

(*From the Crockery and Glass Journal Sept. 23rd.*)

Trade opened in earnest last week, and there is not a house in the crockery district that has not been visited by dealers in the city. In fact, there are many lines, especially in glassware and lamps, that are decidedly short, and orders are considerably behind. One of the agents of a Western glass house has declared that it is of no use to take any more orders, and the only thing he could do to pass away the time was to call on his customers and catch a foretaste of future punishment for not filling their orders.

Dry Goods.

(*From the U. S. Economist and Dry Goods Reporter, Sept. 25th.*)

Business with the jobbers has been of somewhat lessened proportions during the past week, that is, the extreme activity has somewhat abated. There has, however, been a steady and good business done with almost all sections of the country, and it promises a fair continuation. August showed so much advance over last year that it was feared by some that a diminution would occur in September, but contrary to expectations this month has shown a larger improvement in the amount of sales over last year, and it is generally conceded that the season has been thus far the largest and best our jobbers have had since 1879.

The market, though it shows some abatement with the jobbers in activity from the past two or three weeks, is steady, active and strong.

The market as to prices remains strong and still with an upward tendency upon many goods. But few changes are to be noted this week, but such as are, are all advances.

Paper.

(*From the Paper Trade Journal of Sept. 25th.*)

Low water at some of the mills is causing a partial shut-down, and the effect is felt to some extent in a lack of some sizes and weights of paper. As yet, however, there has not been any result, so far as higher prices are concerned, but some of the manufacturers and dealers expect that there will be an advance, the latter especially coupling with the expectation a hope that the dry season may continue. The mills are fairly supplied with orders, and those running on prime grades are well sold ahead. The local market displays more activity, although not to any marked degree. The demand is of a wider character, which is at least encouraging. Writings are having a better call, and prices are steady, although not higher. Some very good orders for book papers have been placed during the past week, and, as a rule, this line is moving at a steady price, especially for the better makes. News is quiet. Manillas are in better request, but sellers are not getting any more money for their wares.

Anthracite Coal.

(*From the Engineering and Mining Journal, Sept. 25th.*)

Higher prices will undoubtedly prevail during next month, while at the same time there is a probability of trouble with the miners. Should the latter occur, it will be a great favor to get coal at any reasonable price.

There is a moderate amount of coal sold at new prices, and an active movement on old sales. The outlook for a remarkably good fall trade, with firm and advancing prices, is as good as it ever was in the history of the trade. In fact, owing to the very large general traffic of the coal carrying roads, it is a grave question whether they will be able to carry all the coal demanded by the market.

Drugs.

(*From the Oil, Paint and Drug Reporter, Sept. 29th.*)

There is no mistaking the signs of activity which are everywhere apparent in the drug market. The prosperity which has been so often foreshadowed in these columns during the past six months has made its appearance, and from all present indications has come to stay for a while. It has been gradual in its approach, and only within the last week or two have importers and jobbers realized to the full how great the volume of business really is. Orders are pouring in from all quarters with such rapidity as to tax to the utmost the capacity of the large jobbing houses, and in not a few instances, their force of clerks have been compelled to work long after sundown to supply the demands of customers.

The steady improvement in prices which is now taking place, and has been a prominent feature of our market reports for some time past, is a natural result of the increase of trade, and is in marked contrast with the spasmodic and large jumps which took place in 1879 and 1880, the years of the boom. But there is no boom this time. We are simply passing through a natural reaction from the depressed condition of trade during the past two years or more, which has every appearance of healthy permanence.

Leather.

(*From the Shoe and Leather Reporter, Sept. 30th*).

In reflecting upon the remarkable increase of activity in business, we have been trying in some way to account for the fact that, while everything else is moving briskly, leather, so far, rather hangs fire; at any rate, it has not materially advanced.

Hardware.

(*From the Iron Age, Sept. 30th.*)

There is little variation in the tone of the market, the demand continuing steady and prices unaltered, with perhaps a tendency toward greater firmness. Purchases are limited almost entirely to the regular demands of current trade, there being very little disposition to place speculative orders. There is, however, a noticeable firmness in several lines of goods, especially in heavy hardware, where the influence of the increased cost of the raw material is directly felt. There is some complaint that collections are slow.

Jewelry.

(*From the Jewelers' Circular and Horological Review for September.*)

The fall trade has already set in. The indications are that it is to be an excellent one and that during the next four months there will be an activity displayed in the jewelry trade such as has not been known before in several years. It is comparatively a healthy and vigorous demand that has started, growing out of the wants and conditions of the consumers who find themselves in a financial condition that warrants the gratification of their tastes and the indulgence in luxuries to a considerable extent. The spring trade, which was delayed on account of strikes, seems to have joined hands with the regular demand of the fall months and promises to make things lively for some time to come.

Furniture.

(*From the Trade Bureau, Sept. 25th*)

There has been little change in the condition of trade in New York during the week. The market has maintained the same degree of activity, and heavy shipments of all kinds of goods have been made daily. While the demand for stock is brisk and the manufacturers well employed on orders, considerable grunting is still heard about the want of snap; but it is as well to growl about that as anything else during breathing spells. According to individual reports trade is in a healthy condition, and promises to hold out so during the balance of the season.

In upholstery goods the wholesalers are doing an excellent business, city trade having improved to a marked degree during the past ten days. Lace curtain trade is heavy.

Iron and Steel in Pittsburgh.

(*From the National Labor Tribune, Sept. 25th.*)

The demand for iron and steel is still improving, but the volume is about at the highest point, so far, at least, as the puddling furnaces are concerned. There are now only 30 idle and 40 on single turn, which is less than the oldest iron worker has ever seen in this city. In the finishing departments there are more finishing rolls on double turn than have ever before been seen.

Carriages.

(*From the Hub for September.*)

Active preparations for a promising fall trade are now reported from nearly all the leading carriage centers, especially Amesbury and Cincinnati. Certain individual exceptions to the above general statement of the trade situation will be found duly noted under "Trade News," wherein we endeavor to include, each month, all noteworthy straws that float within our circle of vision; but it will be noticed that most of these indicate a greater rather than a less degree of prosperity than we have above implied.

Lumber.

(*From the Northwestern Lumberman, Sept 25th.*)

Reports from various points, east and west, this week, have a more pronounced tone of satisfaction with current trade than at any previous time this season. The volume of trade at large, while not of the speculative, rushing order, is large, steady and promising of future health. Advices from the Eastern States, and from Mississippi River and North Wisconsin manufacturing and market points, are more encouraging than last week. A cheerful feature of reports is the concurrent testimony that late advances of prices are being sustained. Statements to this purport come from Clinton, Necedah, up river points and Toledo, Manistee and Cleveland, showing a range of better condition quite extensive. Our local reports are to the effect that more money is being realized for lumber in this city than there was a few weeks ago.

* * * * * *

It is plain that the average value of lumber has secured a firm footing on a higher range than characterized summer dealings. This footing is likely to be maintained until next spring, at least. No man can truthfully predict beyond that time.

* * * * * *

A noteworthy feature of the present situation is the prosperity that prevails at the East. Though a large part of the surplus of money that last year was idle has been absorbed by the requirements of trade and manufactures, as a consequence of improved business, real estate investment, and building in the large Eastern cities were never more extensive than now.

Whiskey.

(*From Bonfort's Wine and Spirit Circular, Sept. 25th.*)

In the wine and spirit trade the fall business is backward, owing to the long continuance of warm weather; but the indications are that the season will be a lively one. The demand for 1887 whiskey is very small, although some houses have already made good sales from their coming crop. The majority of good houses East refuse to contract for whiskey. There is a strong advance in goods older than 1885.

Groceries.

(*From the American Grocer, Sept. 22d.*)

Activity continues in all business circles. The exchanges for the week show a gain over the corresponding week last year of 27 per cent. There is a good export demand for American breadstuffs. Coffee has reacted about half a cent from the highest point. The sugar market is firmer at a slight advance. Tea well held and unchanged. Spices quiet and steady. Fruits and nuts dull, and tendency easy, except for currants, which are firmer. Canned goods in fair request. Molasses dull and nominal. Butter and cheese higher. Wheat and corn lower. Pork and lard lower.

Many complaints have been heard of late in England concerning the management of the North-British Railway in so illy lighting their cars while passing as they do through long tunnels. Before electrical lighting was known to be a success the public patiently bore with the inconvenience, but now they have concluded, and rightly be it said, that there is no longer any reason for confining the lighting of such trains to a few snuffy and ill-smelling lamps. Compelled to take some action in the matter, the company hit upon gas as a means of quieting the grumbling. It only increased it, however, for whilst it gave more light than the lamps, it rendered the atmosphere of the compartments still more unbearable. Then the managers did what they should have done at first; they adopted electricity, or rather they began to experiment with electricity on their trains, and such success has been had that it will no doubt soon be a permanent institution on their line.—*Electrical Review.*

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

Horace B. Miller, Pres't.
Jackson Bailey, Vice-Pres't.
Lycurgus B. Moore, Treas. and Sec'y.
96 Fulton Street, New York.

Jackson Bailey, Editor. Horace B. Miller, Business Manager.

F. F. Hemenway, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 Bouverie Street, Fleet Street, London, Eng., will receive subscriptions for the American Machinist, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.
$3.50 a year to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, OCTOBER 16, 1886

CONTENTS.

	PAGE
Combination Mitre Saw Table	1
Manufacturing by Proxy	1
Vertical Engines for High Speed and High Steam. By William H. Hoffman	1
Evening Schools for Mechanics	1
Production of Aluminum Bronze Metal. By Thomas D. West	2
The Mason Pressure Regulator	2
Maritime Exhibition at Havre	2
The Curving Qualities of Locomotives with High and Low Centers of Gravity	3
Lathe Center Grinder	4
Fires Due to Dirt	4
Starting Right in Building Works	4
Railway Master Mechanics' Association Matters	4
Ruthenburg's Chemical Engine	5
Letters from Practical Men—About Cutting Tools—Roll Turning. By S. W. Goodyear—Locomotive Check Valve. By W. H. Bradt	5, 6
Automatic Cellar Drainer	6
Mitis Wrought-Iron Castings	6
Improving Machinery	6
Condition of Leading Industries	7
Cheap Engineering Education	8
New Methods of Trade	8
Keeping Down City Taxes	8
An Exhibition of Titles	8
Cast Iron in Machine Structure	8
Questions and Answers	9
Business Specials	9
Manufactures	9
Machinists' Supplies and Iron	10

We are pleased to announce this week that Mr. J. G. A. Meyer, whom our readers know as the author of the series of articles on "Modern Locomotive Construction," now running in our columns, has made a regular engagement with the American Machinist, and will hereafter devote himself to work in our editorial department. Mr. Meyer is an experienced mechanical engineer and is familiar with both railroad and other mechanical practice. He was with General McClellan four years while the latter was Superintendent of the Department of Docks in this city. For some time he was engaged in Roach's shipbuilding establishment and during the last ten years has been chief draftsman and designer at the Grant Locomotive Works, a position which he resigns to accept this new one.

Cheap Engineering Education.

Institutions for turning out engineers by the forcing process—short time and small cost—are becoming so numerous as to suggest, if they really accomplish what they profess, creating a supply beyond the probability of any demand. "Colleges" with pretentious names and unheard-of professors, about which little or nothing is known in a legitimate way, are the order of the day, judging from the inquiries we have about them from different parts of the country. Judging from these same inquiries, it appears that, while nothing in a general way may be known about some of these institutions, they contrive to scatter considerable information where it will, presumably, do the most good.

Whatever an advertisement may be made to say, the old, but never threadbare adage, to the effect that there is no royal road to learning, has never been successfully disputed. There are well-established institutes, where mechanical engineering is taught; but they make no pretensions to having got beyond the process of hard work, and are old-fashioned enough to require reasonable time for educating engineers.

There are no possible objections to institutions of learning because they are new; there are objections to the promises made by some of them. It makes no difference what is under consideration, whether technical or some other kind of education, it takes time for study, and hard work to accomplish anything. There is no way of materially diminishing one of these factors, without correspondingly increasing the other. And there is, at the best, an early limit in the extent to which this can be done. Those who are led by a flattering prospectus to believe that they are to get a good deal of knowledge by little study and work will in the end find themselves in the condition of everyone who expects to get something for nothing.

We cannot undertake to give information about these unknown institutions. In one instance, prompted partly by a desire to oblige and partly by curiosity, we succeeded, the second time trying, in finding one, the location of which was given us by letter. The facilities were comprised in a single room over a beer shop, and the faculty, so far as we were able to learn, was in the singular. In another instance, we were even less successful. The institute had been removed, and the only further knowledge we could obtain was that an unpaid bill for rent was left behind. Since then we are out of the business of looking them up.

New Methods of Trade.

The stove manufacturers of the United States, in their national association, are said to be considering a plan to open retail stores in a large number of the principal trade centers, and sell their productions at a slight advance over wholesale prices. The idea probably grows out of the assumption that "middlemen" are useless, and absorb too much of the profits which belong to the manufacturer. Experience in other industries has proved to the contrary, and if the stove manufacturers wish to test it, they will probably arrive at the same conclusion. Until Jacks-of-all-trades supersede mechanics who are each skilled in a special branch of work, we may expect stoves, and other articles of the kind, to reach the consumer through retail dealers. The manufacturers of machinery can deal directly with the users of their products; but even in this industry efforts to do away with middlemen are useless. There are machinery stores in most of the large cities. Usually each has the agency for the sale of machinery from several manufacturers. During the last twelve or fifteen years, several large machinery manufacturers have each had their own stores in this city stocked with machinery exclusively from their own works. Most of them withdrew after fully trying the experiment, and now find it more satisfactory to pay commissions to regular dealers, who find customers for their products in leading business centers.

The assertion is often made that steam and electricity have revolutionized the conditions of trade. While this may be true in a general way, retail dealers and commercial travelers are just as essential as they ever were.

It is said that Wall street business is likely to be brisk, because the majority of those who buy and sell there are back from their summer vacations. This cannot be said of the majority of manufacturers in the machine line, for the reason that they do not go away for the summer in the sense that the Wall street magnates go. They may get a short outing, during which some one must bear their burdens, to be, in turn, relieved by the harder work of the one who returns. Still, as the cooler weather comes on, it induces the putting forth of more energy, and the embodiment of new ideas in machines is likely to be the result.

There may not be so much in words about the fall revival in machine business as there is about the Wall street revival; but we have faith that the results will be of more advantage to the country.

Keeping Down City Taxes.

The *Iron Trade Review*, of Cleveland, after mentioning that we made a strong point in calling attention to the fact that excessive taxation is driving manufactories from many of our larger cities, and quoting a portion of our editorial on that subject, says:

In the absence of any suggested remedy we venture to offer the following:

In every large city there should be an industrial league, made up of leading manufacturers, whose duty it shall be—

1st. To operate in a non-partisan way in purifying the politics of the city by taking an active interest in the same, with a view to electing the best men to municipal offices and keeping them there as long as the public interests demand.

2d. To see that all taxable property is placed on the duplicate, and that the boards of equalization do their work without fear or favor.

3d. To watch all ordinances introduced in which they have a concern, and see to it that no injustice is done manufacturing interests by rogues or demagogues.

The non-partisan political association would have very little influence ontside of helping certain individuals into office, but we heartily endorse the second and third objects of the league as above noted. The league, moreover, should not be confined to manufacturers, but should take in business men generally. It should be a Chamber of Commerce or a Board of Trade. There are several cities now that have such organizations, which accomplish, in the main, what the *Iron Trade Review* points out as needful. We know that not every organization named as above takes a continuous active interest in municipal affairs, but those that do are mostly model associations to follow. For example we may mention the Chamber of Commerce of St. Paul. It is officered by men who are very energetic in pushing plans for improving and extending the business of the city, and the work is divided among several committees. The result is public confidence in the Chamber—so much so that the Common Council will not even consider a measure of much moment until it has been passed upon by the Chamber of Commerce. Whatever that body recommends the Common Council enacts, and whatever it condemns is in no danger of becoming a law. This may look queer to dwellers in cities where Jakey Sharps buy up Boards of Aldermen and obtain valuable charters, but it is the safeguard of manufacturers as well as all business men, and is the best insurance against the too common municipal extravagance which leads to almost ruinous taxation.

An Exhibition of Titles.

We have received a large 16-page pamphlet, giving information about the American exhibition to be held in London, beginning the 2d of next May. This exhibition promises to be especially valuable to our manufacturers of machinery, many of whom have already secured space. American machinery has already obtained quite a strong hold in England, and an exhibition of this kind is probably the best plan of helping that trade that could be devised. Most of the pamphlet is taken up by a list of the members of the Council of Welcome, the American General Council, and officers of the exhibition. The council which has been constituted to welcome American exhibitors, presents an array of titles that might make an ordinary citizen of this country somewhat timid about facing the wearers of them. The list begins with "His Eminence" and runs through the various ranks: "His Grace, the Duke; The Most Hon., the Marquis; The Right Hon., the Earl; The Right Hon., the Viscount; Capt., the Right Hon., the Lord; Gen., the Right Hon., the Viscount; The Right Hon., the Lord; His Highness; The Right Hon. Sir," down to "Sir" and plain "Esq.," but followed by "His Worship, the Mayor" and "The Right Hon., the Lord-Mayor." Then come the wearers of degrees, as, for instance, "Professor Geo. J. Allman, M.D., LL.D., F.R.S., F.R.C.S.I., F.R.S.E., M.R.I.A., F.L.S., London."

It must tax both the memory and the vocal powers to verbally introduce such distinguished persons.

Turning to the names of the members of the American Council we find that most of them have no rank above "Esq.," outside of the State and city officers. This is an invidious distinction. There are several on the list, especially from the West and South, who are known at home as "the General," "the Colonel," "the Judge," and by other designations of rank. These titles they wear with grace and dignity, and to have their names appear in a pamphlet bristling all over with high-sounding titles, without suitable recognition, is too much of a slight to pass over in silence.

The director of this exhibition in the United States is Burnet Landreth, 702 Chestnut street, Philadelphia, and we suggest that, before he issues another edition of this pamphlet, he better let some Quaker revise the list of notables on the Council of Welcome, so it will not discourage Americans who propose to visit London next year and make an exhibition of their products.

Cast Iron in Machine Structure.

A standard English criticism of American machines into which cast iron enters largely is that they are too light—flimsy. An equally standard criticism of English machines by American mechanics is that they are clumsy, and heavy, beyond, apparently, the requirements of strength. This criticism is about as near right in one case as in the other, and not very near right in either. A little consideration of the comparative strength of English and American cast iron will help to explain the whole metter.

With the weak English iron the necessity for what appears to us as undue strength and clumsiness will be seen to exist. On the other hand it will be seen why, with our strong iron, there is no necessity for the weight and dimensions that must go with construction from weaker iron. The engineering in both cases is probably not much at fault, since good engineering consists in making the best use of materials at hand.

The criticism of American machines by English engineers—"a cast iron affair"—would, we think, be materially modified; not if they

knew, but if they considered the strength of American cast iron; similarly American engineers would be less captious in their criticisms of English machines if they considered the comparative weakness of average English cast iron.

The excellent quality, as to strength, of American cast iron has in this country hindered to some extent the use of substitutes for small iron castings. These substitutes are now coming rapidly into use, and are destined to work an important improvement in machine construction.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(359) W. P., Jersey City, asks: 1. How can I determine the length of a link, the radius and stroke of piston being known? *A.*—There is no rule for this. See answer to G. C.

(360) A. C. H., Brooklyn, N. Y., who sends sketch of safety valve and asks position of weight, does not give weight and center of gravity of lever. If he will read an article on this subject in the AMERICAN MACHINIST of December 6, 1884, we think he will be able to work out the problem for himself. If not, by furnishing the data he will see is called for, we will help him further.

(361) B. M., Foxburg, Pa., asks: Has there been anything invented in the way of a machine to run by a weight, and how much power can be developed in that way? *A.*—Such machines have been used. It is not practicable to develop much power in such a machine. It would require a weight of 33,000 pounds falling through a distance of one foot in one minute of time to develop one horse-power. This will give you an idea of the impracticability of getting much power by the means of weights.

(362) Subscriber, Edgewood, N. Y., asks: 1. Why do engineers speak of pressure as so much per square inch? *A.*—Because the square inch is a convenient unit. There are no objections to speaking of pressure per square foot or per square yard. In these cases the pressure would be as much greater than it is per square inch as there are square inches in a square foot or yard. 2. How can I determine if a pulley is in balance, and if not how can I remedy it? *A.*—If not in balance, it will shake the shaft and surroundings when running at high speed. The way to balance it is to add weight to the light side. 3. What power should an 18″x28″ engine develop, running at 100 revolutions, 60 lbs. steam, cut-off at ¾ stroke? *A.*—It ought to develop 125 horse-power.

(363) J. E., Philadelphia, Pa., asks: 1. What is the difference between dry sand and green sand casting? *A.*—In one case the mould is artificially dried; in the other it is not. 2. How can steel castings be chilled? *A.*—Steel that has sufficient carbon can be chilled in the same way that cast iron is.

(364) J. B. G., Baltimore, Md., asks: Please give me a rule for finding the horse-power a shaft will transmit at different speeds? *A.*—A rule which we believe to be satisfactory for most purposes is: Multiply the cube of the diameter of shaft in inches by the revolutions per minute, and divide by 125.

(365) G. C., West Point, Ga., asks: What is the proper distance apart to connect the eccentric rods of an engine to the link? *A.*—There is no rule for this. In practice this distance is made from 2½, or a little less, to 3 times the full (double) throw of the eccentric; for very small links the distance, as a matter of convenience, is frequently increased.

(366) J. A., Ravenna, Cal., writes: In using a common oil cup for oiling valves and cylinders, I have always thought there was no certainty of the feeding, so I put in oil enough at a time to oil the valve and piston, open the cup wide, and then I am sure it gets there. Do you know of any better way? *A.*—It is the only sure way we know of with the kind of cup we understand you to use. 2. When crank-pin and crank-shaft boxes are warm, 125°, plenty of oil being used, does the heat cause any more friction? *A.*—The heat is evidence that there is more friction than if the journals run cool under the same circumstances.

(367) G. N., New York, asks: What is the reason for placing the brake shoes at the sides of locomotive wheels, thus bringing undue strain on journals, connecting-rod brasses, etc.? I think, by placing the brake shoes on the top of wheels, the strain on the axle boxes would be less, and less pressure will be required to operate the brakes. *A.*—The reason for placing the brakes at the side is that it is the most convenient situation to place and operate them. They have been placed on the top.

(368) B. I. asks: 1. How much lap should the steam and exhaust valves of a 24″x48″ Corliss engine have? *A.*—The ideas of different builders vary in this respect, and the lap is also properly varied a little to suit modifications in construction. The best way to find what the lap should be for any particular engine is to ask the builder of that engine. 2. Should the engine disengage her valves when starting, or not till nearly up to speed? *A.*—Ordinarily-arranged Corliss gear should work full stroke, practically, when starting. 3. What is a good composition for bearings of crank-pin and main journals of an engine? *A.*—Good babbitt metal. If you mean of brass, two ounces of tin to one pound of copper makes a good mixture.

(369) F. W., Cleveland, Ohio, asks: 1. I have an index to milling machines divided into 102, 80, 36, 22, 14 and 4. Can I cut 13, 15, 19, 24 and 25 without changing the work? *A.*—As the numbers you wish to cut are not contained an even number of times in the numbers of index, it is evident you cannot space them with the index. 2. I have a pinion to cut, 2¾″ diameter, 2 teeth to the inch. How many teeth should it have? *A.*—We understand you to mean 2 to the inch circumference, and that the blank is turned 2¾-inch total diameter. In that case 16 is the nearest number of teeth. 3. The book you name will give you the information you want.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

20″, 25,″ 28″ B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

The best wire nail and tack and nail machinery. Wm. A. Sweetser, Brockton, Mass.

20,000 addresses of steam users and users of mach. in 10 States, $10. J. N. Mills Pub. Co., 30 Vesey st., N.Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Oct. 2, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Wanted—Large upright hydraulic press; give dimensions, capacity and price. Woodrough & Clemson, Montvale, Mass.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15, Astor Place, New York.

MANUFACTURES.

H. McGregor is about to start a large plow factory at Mobile, Ala.

F. A. Newsom is erecting a steam grist mill and gin near Oakland, La.

Messrs. Rew, Apalachicola, Fla., contemplate starting an iron foundry.

The Lookout Rolling Mills, Chattanooga, Tenn., will put in five new puddling furnaces.

H. L. Greywack will erect a piano factory, 160x40 feet, on Railroad avenue, West Troy, N. Y.

L. C. Curtis & Co. and Charles Paget will at once erect an extensive machine shop at Oxford, Ind.

The Rhode Island Locomotive Works employ 1,300 men. A year ago they employed but 500.

John Leducke, of New Albany, Ind., will start a new woolen mill at Paoli.

A joint stock company will start a foundry and machine shop in Staunton, Va. M. A. Booker is interested.

The Westinghouse Air Brake Company have increased their capital stock from $600,000 to $3,000,000.

The Bellaire, Zanesville and Cincinnati Railroad Company are building extensive shops near Zanesville, O.

The directors of the Centralia Iron and Nail Works, Centralia, Ill., contemplate adding a steel plant.

Ackworth, Ga., has organized a broom factory. James L. Lemon is president, and J. N. Johnson, treasurer.

The Kentucky and Indiana Bridge Company will erect three buildings for shops at Louisville, Ky. Estimated cost, $25,000 or $30,000.

Stockholders of the knitting mill to be started at Fonda, N. Y., have subscribed $38,000, leaving $12,000 to be subscribed.

It is reported that the Jacksonville, St. Augustine and Halifax Railroad Company are building new shops at Jacksonville, Fla.

Carroll, McCandish & Co., of Bradford, Pa., will immediately erect a manufacturing establishment at Shannopin (Shoustown P. O.)

A stock company will be organized at Staunton, Va., to establish a foundry and machine shop. M. A Booker can give information.

It is reported that the Watson and Zahniser's injector factory, at Sandy Lake, Pa., will be removed to Erie, Pa.

T. M. Avery is president of a company at Kenosha, Wis., that is building a brass rolling mill 75x225 feet, with an engine-room 60x80 feet.

The Baltimore and Ohio Railroad have a building permit to erect a 200x65 foot locomotive repair shop on Fifty-ninth street, Philadelphia.

L. S. Starrett, Athol, Mass., has leased a new building and put in additional machinery to make small tools for machinists and others.

The New York Brewing Company are to put up a building 122x28 feet, of four stories, in Holyoke, Mass., for the manufacture of ale and lager.

Boocy & Co., of Lapeer, Mich., are to build a sawmill at once about a mile from Rogers City, Presque Isle County, on Trout River. It will employ forty men.

The Colorado Coal and Iron Company, of Pueblo, Col., will, it is said, erect a foundry for casting car wheels. The entire works are now in operation.

H. K. Porter & Co., builders of light locomotives for every conceivable use, say that since they started they have built locomotives for 57 different gauges.

The machine shops of the Vermont division of the Boston and Lowell are to be removed, and Maquam, Vt., is one of the places mentioned as the future location.

The Milner, Kettig & Bell Iron Works Company has been incorporated at Birmingham, Ala., to manufacture plumbing supplies of every description. Capital, $50,000.

A stock company is being formed at Columbia, Tenn., to build an iron furnace. J. T. Craik can probably give information.—*Baltimore Manufacturers' Record.*

The Ewald Iron Company, 801 North Second street, St. Louis, has purchased the plant of the Kentucky Rolling Mill Company, Louisville, Ky., and will double its capacity.

The Oregon Iron and Steel Company is reported to have begun suit against Henry Villard and others to compel them to return to the company property valued at $275,000.

The Putnam Machine Company, Fitchburg, Mass., are building a wing to their old foundry 150x60 feet, which will hold 150 workmen. It will be fitted with all modern appliances.

The city of Brooklyn, N. Y., will erect a three-story workshop for the Fire Department. It will be 50x80 feet, and will cost $18,500. City Engineer Van Buren is the architect.

The Phœnix Iron Works, of Meadville, recently shipped to Bangkok, Siam, an engine and boiler to duplicate an order of about eight months ago. The machinery will be taken inland by canoe 200 miles.

In connection with his woolen mill at Guilford, Me., Wm. P. Appleyard is erecting a two-story brick fireproof building, large enough to accommodate two boilers on the first floor and a picker-room on the second.

Easthampton, Mass., is to have another factory for the manufacture of elastic fabrics. It will be of brick, 100x40 feet, two stories high, and will be built for George Colton, an experienced manufacturer from Norwalk, Ct.

The capital stock of the Alabama Iron Works, Birmingham, Ala., is $20,000. Henry Behrns is president; J. Lentz, vice-president; and W. W. Barclay, secretary and treasurer. They will manufacture all kinds of iron.

Arrangements have been about completed between R. Selwood and an outside firm to locate in Fort Plain, N. Y., occupying the old brick hollow ware foundry building, and commence manufacturing mowing machines.

Sohmer & Co., of New York city, have begun the erection of a large piano factory, 235x100, on a part of the Stevens estate, fronting the East River, at Sunswick Terrace, Astoria. It will cost in the neighborhood of $150,000, and will employ about 300 men.

The Automatic Delivering Company, of New York city, has been incorporated, to transport articles by means of pneumatic tubes. Capital stock, $500,000. Roscoe Conkling, Isaac H. Bailey, Peter T. Barlow, 35 William street, L. F. Levis and Edward S. Leaycraft, corporators.

A new manufacturing establishment is to be started in Akron, O., whose specialty will be the manufacture of electric locomotive headlights—a recent invention perfected and patented by Howard Pyle, late master mechanic of the Cuyahoga Manufacturing Company.

The Southern Barb Wire Company, St. Louis, are constructing the basement of their new steel wire nail factory. The building permit calls for a $15,000 structure, to be erected on Twenty-first and Gratiot streets, adjoining the St. Louis Wire Mill on the north side. Forty-seven nail machines will be used in the plant.

The *Neapolitan*, of Naples, N. Y., says: W. H. Van Houten is building a machine shop on the Covel property adjoining the Ontario Mill lot, and it will be a valuable industry to our village. He has the building framed, the ground graded, and in due time we shall see a machine shop running by steam. Success to him.

The Norton Emery Wheel Company, of Worcester, Mass., are building a new factory 48x117 feet, three stories high. It is expected to be ready for running in November They make emery and corundum wheels, and machinery for mounting and running them. Their trade has largely increased during the last few months.

The firm of Laurence & Herkner, belting, of New York city, has been dissolved. A. B. Laurence, formerly of that firm, has become manager for New York and New Jersey for the Underwood Manufacturing Company, manufacturers of cotton-leather belting, which has achieved quite a reputation. His office is at 82 John street, where a full assortment of belting is kept on hand.

L. B. Johns, Fort Wayne, Ind., will erect a new carriage factory. The size of buildings are: Main building, brick, 24x135; wing from same, 85x24; blacksmith shop and storeroom, 90x24, frame; engine-room, iron, brick and wood, machine shop, frame, the three in one building, 147x30; paint shop, 24x100, frame; two-story packing and varnish shop, 76x24, frame; body shop, 30x60, frame. All frame buildings and all roofs to be covered with iron; estimated cost, $15,000.

The silk factory at Belding, Mich., is nearing completion. The building is 45x160 feet. In addition to this building, there will be a boiler-house 19x34 feet. The factory will be built entirely of brick, with a composition roof. The first floor will be of concrete and cement. It is to be three stories high, and will cost, exclusive of machinery, $12,000. A tower, 16x18, will grace the front of the building, and will also serve as the main entrance. The factory, when ready to commence operations, will give employment to between 200 and 300 hands, a good share of which will be imported labor.

The new planer in the Boston and Albany machine shops at Springfield is now at work. It was made by the Pond Machine and Tool Company, of Worcester, weighs 37 tons, and is 5 by 5 feet between the posts; the bed is 36 feet and 4 inches long, and the table 20 feet. The bed and table are made of gun metal, and were cast in the Government works in South Boston. The company that made it are manufacturing two planers even larger, for use in the West, 7 feet wide between the posts, and with a bed 45 feet long. All these planers are of unusual size, the last, it is said, being among the largest ever built.—*Manufacturers' Gazette.*

Reynolds' feed-water heater, illustrated in our issue of May 22d, 1886, is meeting with success. We recently saw a boiler containing one of these heaters opened for inspection at Doty & McFarlan's dye manufactory, Brooklyn, N Y. The boiler had been run six weeks, and it was entirely clean inside. Other boilers in the same steam plant, run without this heater, contained some scale and sediment. Reynolds' heaters have been put in Dougherty's rubber works and Greenlang's mat factory in Brooklyn, and have been ordered for the Brooklyn Water-Works and the Fire Department; also for several manufactories in that city.

The Kilbourne & Jacobs Manufacturing Company, Columbus, O., are about to erect new shops on a seven-acre tract of land between Russell and Warren streets, and on the line of the C., C., C. and I. Railroad. These shops are to be quite extensive, as will appear from the list of buildings, as follows Truck shop, 60x200 feet; wood-working shop, 45x200 feet; machine shop, 45x200 feet; blacksmith shop, 75x150 feet; main set up shop, 75x200 feet; stamping shop, 75x129 feet; punch and shear shop, 75x120 feet; sink warehouse, 45x160 feet; general warehouse, 45x314 feet; boiler-house, 40x60 feet. In addition to the above, there will be buildings for the offices of the company, and for store-house, paint-house, etc. All of the buildings, with the exception of the stamping room and main set-up shop, will be of brick, with slate roofs, and are to be first-class in every particular. The stamping room and the large main set-up shop are to be of iron throughout, and absolutely fire-proof — no wood whatever being used in their construction. *Age of Steel.*

Machinists' Supplies and Iron.

NEW YORK, Sept. 30, 1886.

Iron—There is nothing new in transactions in American pig. Demand has continued constant, and prices are held firm. Some of the large producers, notably the Thomas Iron Company, have sold their entire product for this year, and refuse to make contracts for next year at current prices. We quote No. 1 X Foundry, $18 to $18.50; No. 2 X, $17 to $17.50; Grey Forge, $15.75 to $16.25.

Scotch Pig—The demand for these brands has been a little more active during the past week, but prices have not been seriously affected. We quote Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.75 Eglinton, $18; Langloan, $19.50.

Lead—There has been a decline in price to 4.45c. for Western.

Copper—Lake is selling at 11c. to 11½c.

Antimony—Hallett's, 7.60c. to 7.70c.; Cookson's, 8.90c. to 9c.

Spelter—Refined, 5¾c. to 6c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Machinists, send address to L. S., AM. MACHINIST.

An A 1 planer and slotter hand wants work; city or country. M. P., 357 9th ave., N. Y.

Wanted—Position by an experienced machine shop foreman; references. Address West, AM. MACH.

Mech. engineer and draftsman, competent and reliable, desires situation. Address Peta, 1,257 Garden street, Cleveland, Ohio.

An experienced draftsman and designer on steam engines and general machinery would like to change position. Address Experience, AM. MACH.

Draftsman and machinist with extensive experience in labor-saving machinery and inventions; references second to none, desires engagement with responsible party. Square, No. 35 B'way, r'm 8, N.Y.

Wanted—By a practical tool-maker and machinist, a position as foreman; have had large experience in handling men; best references. Address S. C., Box 5, AM. MACHINIST.

Wanted—First-class moulders for heavy and light work and general jobbing; good wages and steady work. Apply at the Watson Machine Co., Paterson, N. J.

An experienced mechanical draftsman on general, special and automatic machine design desires a situation; Boston or vicinity preferred. Address Box 17, AM. MACHINIST.

A marine engineer and machinist, of many years' experience in the running and superintending the repairs of steamers, is open for engagement; at present in charge of machine shop doing the repairs to the machinery of a large concern near New York city; can do designing if necessary. Address S. J., AM. MACHINIST.

Wanted—Foreman for machine tool department of a large stationary and portable engine works; must be a draftsman and familiar with valve movements and high-speed automatic engine work; must understand handling men; to the right person there is an opportunity to secure the position of superintendent of the establishment. Address, stating age, T. E. J., AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent solid lubricant, clean, durable, cheap; prevents hot boxes. Crescent Mfg. Co., Cleveland.

The Crescent automatic grease cup is adapted to every service. Crescent Mfg. Co., Cleveland, Ohio.

Steel stamps, stencils, burning brands, and brass checks. T. M. Parker, Hartford, Conn.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

For Sale—Small machine shop and foundry; well located; full or half interest. S. & H., AM. MACH.

Xperimental work for inventors; fine work and quick. LeRoy & Sharpe, 96 1st st., Br'kl'n, E.D., N.Y.

Wanted—Correspondence with parties wanting a small machine shop; foundry in connection; natural gas in use. Address John Marshall, Kittanning, Pa., Box 66.

For Sale—Whitcomb planer, 8′×27″×27″, good as new, one 10′ lathe 18″ swing; planer patterns for 6′×24″×24′, and special tools. Woodman & Weare, Laconia, N. H.

Machinery—Sept. list sent on application; new & 2d-hand engines, lathes, planers, shapers, drills. C. L. Jackson & Co., Mach'ry, Tools & Supplies, Balto., Md.

The best engines and boilers, ½ to 4 H.P.; economical in price, steam, etc. Washburn Engine Co., Medina, Ohio.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E.D., N.Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

Wanted—A first-class cotton and woolen shuttle maker as partner; a good opportunity for a man (who understands the business) with a small capital. Address Box 4, AM. MACHINIST.

For Sale—The best-appointed and best-located machine shops in the Northwest—the plant and shops of the St. Paul, Minnesota, Harvester Works; to be sold on sealed bids, Oct. 15th. Pamphlets, containing maps, description and terms, sent to any address, on application to Lyman D. Hodge, assignee, No. 47 Gilfillan Block, St. Paul, Minn.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

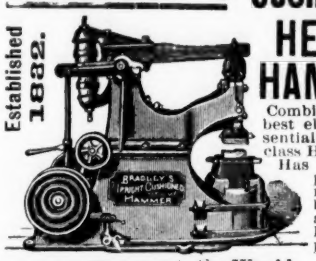
Send for estimates of high-speed compound enginss for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

For Sale—The machinery, tools, plating apparatus and raw material of manufacturing establishment; now working on orders in brass and other metals; very low rent, including steam power. Address Manfr., P.O. Box, 285, New Brunswick, N.J.

For Sale—A first-class foundry and machine shop; large connection in saw-mill county in the South, including buildings, lots, machinery, and mills' supply stock on hand; business will be carried on until sold; reason for selling, retiring from business; apply at or address Southern Foundry, AM. MACHINIST.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.

H.W. JOHNS' ASBESTOS ROOFING

FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail.

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

CHICAGO—PHILADELPHIA—LONDON.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER

The success of our Machine is the best guarantee of its value. Only machine with Double Helve. Does more and better work with less repairs than any other.

BEAUDRY & CUNNINGHAM, Boston, Mass.

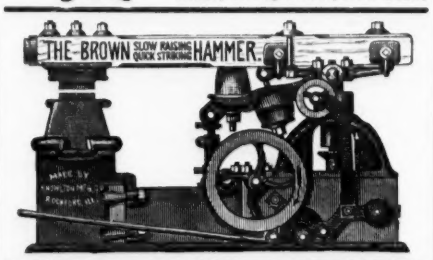
STEPHENS PATENT VISES.

50 PER CENT. OF time and labor saved by using this solid, strong, durable, quick-working Vise. Has the Improved Taper, Pipe and other attachments. Sold by the trade. Send for circular

MELVIN STEPHENS, Prop'r.

Office, 41 Dey Street, New York.

THE BROWN HAMMER



STRIKES A BLOW WITH

Double the Velocity That it Raises the Hammer.

A NEW MOVEMENT! SEND FOR DESCRIPTION.

Knowlton Mfg. Co., King St., Rockford, Ill.

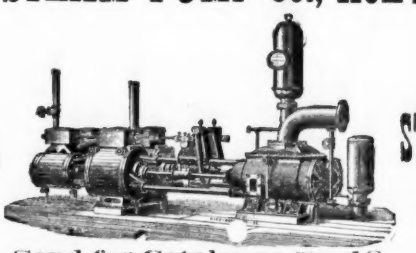
KNOWLES Steam Pump Works.

93 Liberty St. NEW YORK. | 44 Washington St. BOSTON.

IMPROVED PUMPING MACHINERY For Every Class of Work. SEND FOR NEW ILLUSTRATED CATALOGUE.

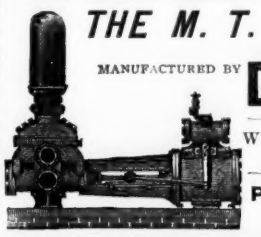
THE DEANE STEAM PUMP CO., HOLYOKE, MASS.

BUILD WATER WORKS, ENGINES AND STEAM PUMPING MACHINERY.



Send for Catalogue No. 18.

THE M. T. DAVIDSON IMPROVED STEAM PUMP,



MANUFACTURED BY **DAVIDSON STEAM PUMP COMPANY.**

WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.

PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.

NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

THE HENDEY MACHINE COMPANY. MANUFACTURERS OF TORRINGTON, CT. Machinists' Tools, LATHES, PLANERS, SHAPERS, DRILLS, ETC., ETC. *SEND FOR CATALOGUE*

THE **Westinghouse Machine Co.**

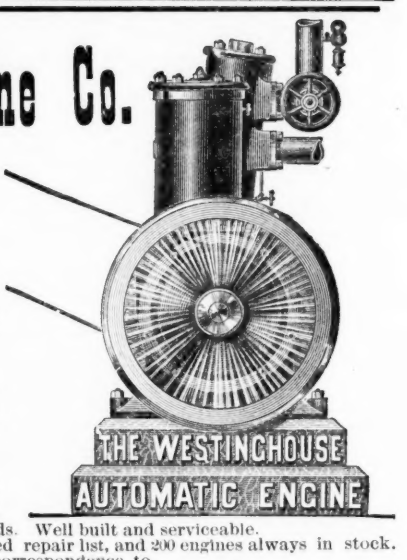
OF PITTSBURGH,

MFRS. OF THE

WESTINGHOUSE AUTOMATIC ENGINE

—AND THE—

"JUNIOR" AUTOMATIC ENGINE.



ENJOYING the largest market of any engine manufactured in the U. S, we shall further enlarge it by a rebate to the purchaser of a share of our earnings in the shape of a

General Reduction of Price.

THE first reduction is now in effect, and others will follow as results warrant. All our latest improvements are in force.

THE "JUNIOR" AUTOMATIC ENGINE

is a special design for the Legitimate Low Price Trade. Sizes, 15, 25 and 35 H. P. only, which we **SELL AT A PRICE THAT CANNOT BE MET** by the cheapest throttling engines. Forged steel shafts and rods. Well built and serviceable.

Add to the above, absolute uniformity of parts, a priced repair list, and 200 engines always in stock, and our position in the trade is invincible. Address all correspondence to

WESTINGHOUSE, CHURCH, KERR & CO.

17 CORTLANDT ST., NEW YORK. | 98 FOURTH AVE., PITTSBURGH.

FAIRBANKS, MORSE & CO., Chicago, Ill.
FAIRBANKS & CO., St. Louis, Mo.
D. A. TOMKINS, & CO., Charlotte N. C
PARKE & LACY, San Francisco, Cal.
PARKE, LACY & CO., Salt Lake, Utah.
ROBERT MIDDLETON, Mobile, Ala.
H. DUDLEY COLEMAN, New Orleans.
KEATING IMPLEMENT & MACH. CO., Dallas, Texas.

STEWART'S READY ROOFING PATENT

For ROOFS OF ALL DESCRIPTIONS, steep or flat, can be applied by ordinary workmen having no previous experience. Send for Samples and Illustrated Pamphlet. Address

W. H. STEWART,
74 Cortlandt Street, New York.

IRON-FIBRE PAINT, for Roofs and Factory and Farm Buildings.

COOKE & CO., DEALERS IN

Machinery and Supplies,

22 CORTLANDT ST., NEW YORK.

AGENTS FOR

The Waters Perfect Governor.

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also,

SUPPLIES

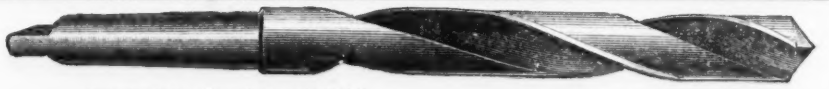
For Machinists, Railways, Mills, Mines, Etc.

Please send for circular and state that you saw the advertisement in this paper.

Business Opportunity.

TO LEASE or FOR SALE. Machine shop and foundry paying large profits. Shops Leadville, Colo. Address,

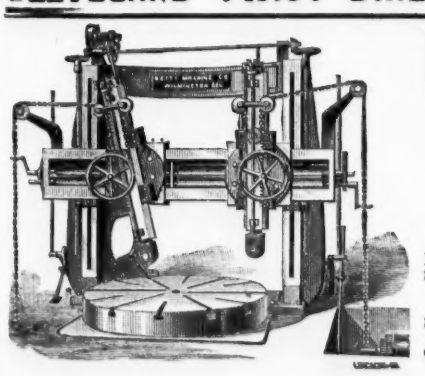
A. FALKENAU,
Care of DICKSON MFG. CO.
SCRANTON, PA.



Established in 1874.

CLEVELAND TWIST DRILL CO.

24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.



Boring and Turning Mills

MADE BY

BETTS MACHINE CO.

WILMINGTON, DEL.

NOTE THE FOLLOWING ADVANTAGES.

Positive feeds, no **friction.**
Spindles **entirely independent,** can be moved simultaneously in opposite directions with different grades of feed.
Spindles not **round,** but of such shape as will allow ready adjustment for wear.
Great range of feed and abundance of power.

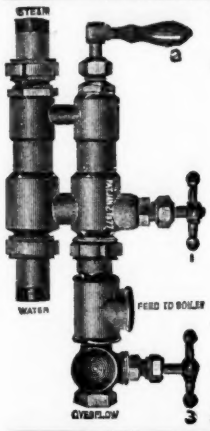
NICHOLSON FILE COMPANY, *Sole Mfrs. of*

FILES and RASPS Having the Increment Cut, also, FILERS' TOOLS and SPECIALTIES.

The above illustration represents a device in which files may be held for service in surface filing, and while in this condition READILY SPRUNG, in order to give at the will of the operator, more or less convexity to the working face of the file. It does away with unusual care to obtain a true convexity or "belly" to file sides, and in fact renders great service by enabling the operator to utilize the file to its full capacity.

SURFACE FILE HOLDER No. 4, Adapted to Hold Files 12, 13 14 in. Long.
" " " " 5, " " " 14, 15, 16 "

MANUFACTORY AND OFFICE - - PROVIDENCE, R. I., U. S. A.



THE HANCOCK INSPIRATOR.

THE STANDARD

BOILER FEEDER FOR ALL CLASSES OF BOILERS.

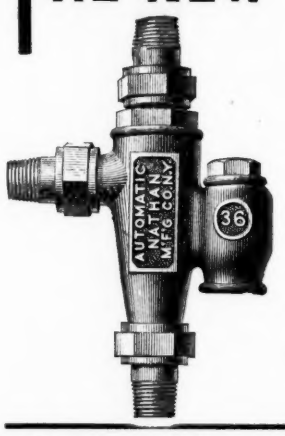
OVER 85,000 IN USE.

Send for Circulars and Price Lists.

THE HANCOCK INSPIRATOR CO.

OFFICE, 33 INDIA WHARF, BOSTON, MASS.

THE NEW "GRESHAM" PATENT



AUTOMATIC RE-STARTING INJECTOR

"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of restarting automatically, immediately after interruption to feed from any cause."

SEND FOR CATALOGUE. RELIABLE AND CHEAP.

Sole Manufacturers in the United States & Canada,

NATHAN MANUFACTURING CO.

92 & 94 LIBERTY ST., NEW YORK.

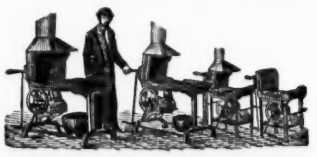
WATER WORKS MACHINERY
A SPECIALTY.

Cor'sp'd'ce Solicited. **POND ENGINEERING CO.** St. Louis, Mo.

P.H. & F.M. ROOTS,
Connersville, Indiana,

MANUFACTURERS OF

PORTABLE FORGES, TUYERE IRONS, ETC.



ROOTS' NEW ACME HAND-BLOWERS.

Slow-speeded, Force-blast. Durable, Compact and Cheap.

Roots' Foundry Blowers, Gas Exhausters, etc.

S. S. TOWNSEND, Gen. Agt. } 22 CORTLANDT ST., NEW YORK.
COOKE & CO., Selling Agts., }

In Writing, Please Mention This Paper.

——BOOKS ON ENGINEERING, ETC.——

BENJAMIN'S Engineers' and Mechanics Recipes, 12 mo, cloth	$2 00
BIXBY'S Graphical Computing Table	75
BOLLER'S Highway Bridges, 8vo, cloth	2 00
BURR'S Hudson River Tunnel, 4to, cloth	2 50
" Stresses in Bridges, etc., 8vo, cloth.	3 50
" Elasticity and Resistance of Materials, 8vo, cloth	5 00
BUTT'S Engineer's Field Book, 12mo, morocco tips	3 00
CHURCH'S Statics and Dynamics for Engineers, 8vo, cloth	2 50
COLBURN'S Locomotive Engineering, 2 vols, 4to, cloth	10 00
CORTHELL'S Mississippi Jetties, 8vo, cloth,	5 00
CROMWELL'S Toothed Gearing, 12mo, cloth	2 00
" Belts and Pulleys, 12mo, cloth,	2 00
DREDGE'S Pennsylvania Railroad construction and working, folio, ½ bound	20 00

John Wiley & Sons, 15 Astor Place, New York.

Catalogues and Circulars Gratis.

OIL CUPS

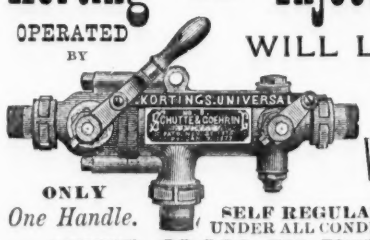
For Engines, Shafting, &c.
Illustrated Catalogue Free.

J. E. LONERGAN & CO.

Philadelphia, Penna.

Korting DOUBLE TUBE Injector.

OPERATED BY



WILL LIFT Hot Water.

ONLY *One Handle.*

SELF REGULATING UNDER ALL CONDITIONS

— OVER 60,000 IN USE. —

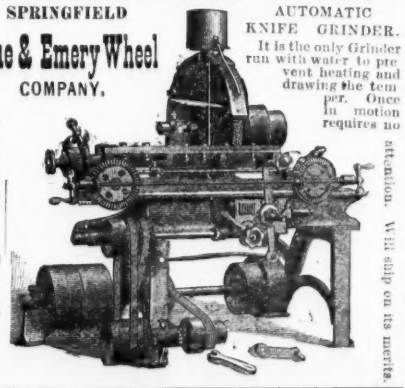
SEND FOR DESCRIPTIVE CIRCULAR.

A. ALLER, - 109 Liberty St. New York.

SPRINGFIELD Glue & Emery Wheel COMPANY.

AUTOMATIC KNIFE GRINDER.

It is the only Grinder run with water to prevent heating and drawing the temper. Once in motion requires no attention. Will rip on its merits.



Springfield, Mass.

FORBES & CURTIS, Mfrs. of FORBES' PAT. DIE STOCK,

BRIDGEPORT, CT.

Pipe Cutting and Threading **MACHINES, ETC.**

WHY THIS IS PUT HERE!

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

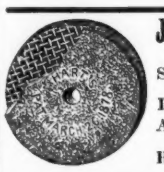
PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.

REDUCED PRICES OF LeCount's Light Steel Dog

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	3/8	$ .35	8	2	$1.10
2	1/2	.35	Small Set of 8-5.50		
3	3/4	.50	9	2 1/2	1.40
4	1	.60	10	3	1.50
5	1 1/4	.75	11	3 1/2	1.70
6	1 1/2	.85	12	4	1.90
7	1 3/4	1.00	Full Set of 12-12.00		

C. W. LECOUNT,

SOUTH NORWALK, CONN.



J. WENDELL COLE, M. E.

Manager of Pennsylvania Southern Lake regions and the Northwest for

DETROIT EMERY WHEEL CO.

Address, Box 84, Columbus, O., or P. O. Box 152 Chicago.

Hart's Corundum-Emery Wheels.

USE THE *Mason Pressure Regulator* FOR STEAM PUMPS

Address: **MASON REGULATOR CO.**

22 Central Street, Boston, Mass

THE TANITE CO., OF STROUDSBURG, MONROE CO., PA., is one of the oldest concerns in the Emery Wheel business. Its goods have long been recognized as *the Standard*, and it has a world-wide reputation. Nearly twenty years of experience have given it such knowledge as to general mechanical wants, that, when its customary qualities do not suit, it can manufacture special goods to meet special needs. When Phosphor Bronze was introduced in Car Brasses, the Emery Wheels previously used with success, failed, but a new quality was at once produced which fully met the want. In like manner, the Automatic Saw Sharpeners, so largely used in the West, called for an entirely new quality of Wheel, and that has been successfully furnished. Special Wheels have also been supplied for use on Brown & Sharpe's Surfacing Machine, and have met with unusual success. Many of the best known firms in the United States have goods specially made by us to suit their individual requirements.

We solicit the orders of *all workers in wood or metal*, assuring them we can supply standard goods suited to the requirements of Foundries, Machine Shops, Railroad and Car Shops, Hardware, Stove and Agricultural Implement Makers, and Saw and Planing Mills, and Sash, Blind, Door and Moulding Mills, and can build specially designed machines or make special classes of wheels to meet the most exacting demands. Among the special machines recently built by us, is one for grinding the Doctor Knives used in a Cotton Mill, and one for grinding the Dies of the Bliss Punch. We manufacture a large variety of Standard Machines, built to carry solid Emery Wheels, and, besides the Standard Tanite Wheel, make a *Water proof Emery Wheel* for wet grinding.

Catalogues and Circulars mailed free on application, and discounts quoted when goods needed are specified.

CUPOLA *Polishing Frame.*

ON WHICH TO RUN WOODEN POLISHING WHEELS.

Emery Wheels, Grinding Machinery and Tools, and Polishing and Plating Goods of all kinds.

UNION STONE COMPANY,

38 and 40 Hawley St., BOSTON, MASS.

SHEPARD'S NEW $60 SCREW-CUTTING FOOT LATHE.

Gap Lathe, $125.

Foot and Power Lathes, Drill Presses, Scroll-saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.

Lathes on trial. Lathes on payment.

Send for catalogue of Outfits for Amateurs or Artisans.

Address, H.L. SHEPARD, Agent, 134 E. Second St., Cincinnati, O.

THE

Slate Sensitive Drill

Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a switching table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for circular.

DWIGHT SLATE,

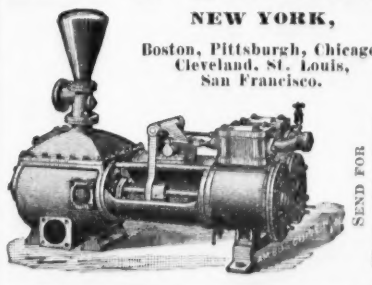
Hartford, Conn.

WORTHINGTON PUMPING MACHINERY

HENRY R. WORTHINGTON,

NEW YORK,

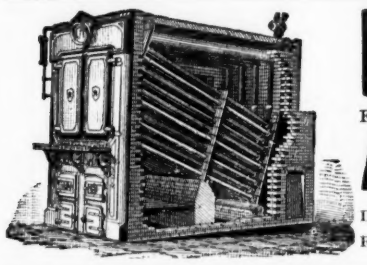
Boston, Pittsburgh, Chicago, Cleveland, St. Louis, San Francisco.



SEND FOR Illustrated Catalogue.

SAFE ECONOMICAL DURABLE BOILERS
HARRISON SAFETY BOILER WORKS. PHILADELPHIA. PA.
MERITS PROVEN 20 YEARS RECORD

"STEAM" A VALUABLE BOOK for EVERY STEAM USER AND ENGINEER
PUBLISHED FOR FREE DISTRIBUTION, BY
THE BABCOCK & WILCOX CO.
Manufacturers of
WATER-TUBE BOILERS,
107 Hope St., GLASGOW. *30 Cortlandt St., NEW YORK.*



ROOT'S NEW WATER-TUBE STEAM BOILER
SAFE! ECONOMICAL! DURABLE
FOR ILLUSTRATED CATALOGUE OF NEW BOILER, ADDRESS,
ABENDROTH & ROOT MANUFG. CO.
—28 CLIFF STREET, NEW YORK.—
SELLING AGENTS.
DANIEL KELLY, 51 N. 7th Street, Philadelphia, Pa.
A. S. FISKE, 48 Johnston Building, Cincinnati, Ohio.
R. L. WEEKS, 151 Griswold Street, Detroit, Michigan.
WM. H. SMITH, 5 Custom House Street, Providence, R. I.

TWO HORIZONTAL TUBULAR BOILERS
FOR SALE.
Two New Horizontal Tubular Boilers, of the following Description:
Material, Parke Bros & Co.'s Flange Steel, 60,000 lbs tensile strength, each boiler is 72 inches in diameter, 16 feet long; dome, 40 in. x 40 in.; shell, ¾ in. thick; heads, ⅝ in. thick; one man-hole on top of boiler, and one in front head, beneath the tubes; one four inch flange on the bottom of the boiler, about 6 in. from back head; full front and fixtures go with each boiler. These are strictly first class boilers in every respect, were made to order and are a bargain. For full particulars, address
NATIONAL WATER TUBE BOILER COMPANY,
NEW BRUNSWICK, NEW JERSEY.

BRIDGEPORT BOILER WORKS.
SEE THE IMPROVEMENTS IN STEAM BOILERS, BOILER FRONTS, BOILER FURNACES, AND FEED WATER HEATERS MADE AT THESE WORKS BEFORE BUYING STEAM PLANT. SEND FOR HISTORIES OF STEAM BOILERS AND FFED WATER HEATERS (FREE) ON MENTIONING THIS PAPER. WM. LOWE.
BRIDGEPORT CONN.

BUILDER OF
BOILERS, GAS HOLDERS, GAS GENERATORS,
Henry Warden,
GERMANTOWN JUNC., PHILADELPHIA.
Successor to WARDEN & MITCHELL.
TANKS, STILLS, BRIDGES Etc., Etc.
Hydraulic Riveting Plant and Full Facilities.

STEEL CASTINGS
From 1-4 TO 15,000 lbs. WEIGHT.
True to Pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position or for any service whatever.
40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this.
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for Circulars and Prices to
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.

SEBASTIAN, MAY & COMPANY'S
Improved Screw Cutting
Foot or Power Lathes

Catalogue of Lathes, Drill Presses and Machinists' Tools and Supplies mailed on application. Lathes on Trial.
167 W. Second St., Cincinnati, O.

THOS. H. DALLETT & CO.
13th & Buttonwood Sts., PHILA., PA.
MANUFACTURERS OF
PATENT
Portable Drilling Machines,
VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.
Send for Illustrated Catalogue.

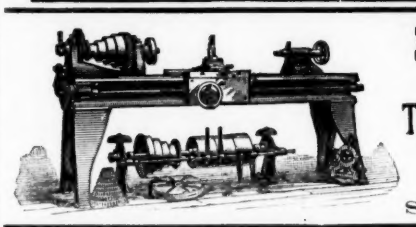
A. J. WILKINSON & CO.,
BOSTON, MASS.,
Makers of the most complete assortment of
Micrometer Calipers and Fine Measuring Tools,
to be found in the world.
Send for Illustrated Catalogue with Tables.

Use the JENKINS STANDARD PACKING in the worst joint you have, and if, after following directions, it is not what we claim, WE WILL REFUND THE MONEY.
Our "Trade Mark" is stamped on every sheet. None genuine unless so stamped. ☞ Send for Price List.
JENKINS BROS.,
71 John Street, N. Y. 79 Kilby Street, Boston.
13 South Fourth Street, Phila

Oneida Steam Engine & Foundry Co., Oneida, N. Y.
Manufacturers of all kinds of LATHE —AND— DRILL CHUCKS
SEND FOR CATALOGUE.
Under Westcott's Patent.

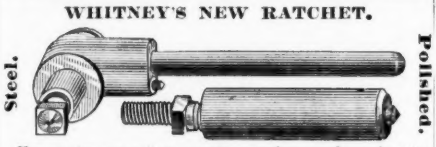
Capacity Little Giant Improved.		
No. 00.	holds 0 to	¼ inch.
" 0	" 0 to	¾ "
" 1	" 0 to	⅝ "
" 2	" 0 to 1	"
" 2½	" 0 to 1	"

STEAM PUMPS
MADE FOR ANY SERVICE
VALLEY MACHINE CO. EASTHAMPTON, MASS.



NEW AND IMPROVED 16" ENGINE LATHE.
The Muller Machine Tool Company.
179 WEST PEARL ST., CINCINNATI, OHIO.
SEND for CIRCULARS & PRICES.

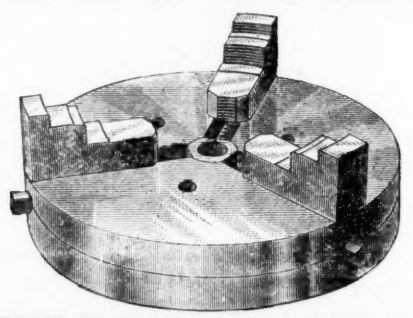
WHITNEY'S NEW RATCHET.
Steel. Polished.



Has greater range than any two ratchets made, and at the price of one. Send for circulars.
VARIETY MACHINE CO., Warsaw, N. Y.

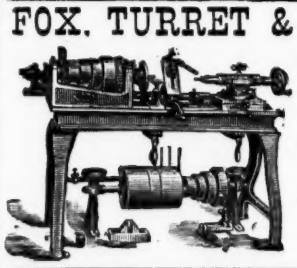
WELDLESS STEEL QUICK OPENING GATE VALVE COLD DRAWN TUBES
SMOOTH INSIDE & OUT.
JOHN S. LENG, 4 Fletcher St N.Y.

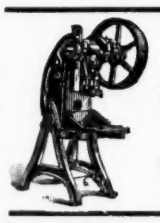
ESTABLISHED 1851.
THE HORTON LATHE CHUCK.



THE E. HORTON & SON CO.
Canal St., Windsor Locks, Conn., U. S. A.

FOX. TURRET & SPEED LATHES AND BRASS FINISHERS' TOOLS,
CAGE MACHINE WORKS,
WATERFORD, NEW YORK.





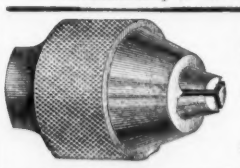
Ferracute Machine Co.,
BRIDGETON, N. J., U.S.A.
PRESSES, DIES
and all other Sheet-Metal Tools.
A new line of PUNCHING PRESSES just out.
Send for Catalogue.

J. C. HOADLEY,
CIVIL AND MECHANICAL ENGINEER
and Expert in Patent Causes,
28 STATE STREET, Room 28, BOSTON, MASS.

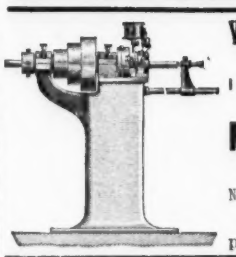
PATENT UNIVERSAL SCREW-CUTTING, CENTER, DEPTH, ANGLE AND
J. WYKE & CO. TWIST DRILL GAUGE.
Fine Machinists' Tools. E. BOSTON, MASS. Send for Circular.

S. ASHTON HAND MFG. CO.,
Toughkenamon, Chester Co., Pa.
MAKERS OF FIRST-CLASS
ENGINE LATHES
Are now in position to put on the market
14" ENGINE LATHES OF NEW DESIGN,
guaranteed to be equal in material, design and workmanship to the best ever offered.

CRANK PLANERS
Superior Design & Workmanship, Extra Heavy (1500 lbs.)
DOWN, ANGULAR AND CROSS-FEED,
TO PLANE 12x16x15.
THE R. A. BELDEN CO., DANBURY, CT.



Almond Drill Chuck
Sold at all Machinists' Supply Stores,
T. R. ALMOND,
83 & 85 Washington St., Brooklyn, N. Y.

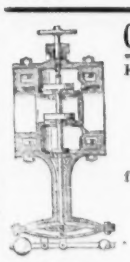


William Barker & Co.
Manufacturers of
IRON AND BRASS
—WORKING—
MACHINERY
140 & 142 E. Sixth Street,
N'r Culvert, Cincinnati, O.
Send for circulars and prices.

Planer Vises, 9 Sizes.
SPECIAL MACHINERY DESIGNED AND BUILT.
The Gilkerson Machine Works,
Write us. HOMER, N. Y.

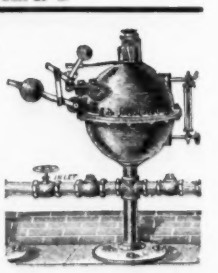
VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

Champion Return Steam Trap and Boiler Feeder.
Kieley's Patent for returning condensation to boilers from steam heaters of all kinds, Drying Cylinders, Evaporating Pans, Brewing Kettles, Paper Dryers, etc., whether above or below the boiler.
EUREKA PRESSURE-REGULATOR,
for reducing the pressure on all kinds of Heating Apparatus, Drying Cylinders, Brewing Kettles etc.
Send for Circulars of Steam Heating Specialties.



Eureka Pressure Regulator.

TIMOTHY KIELEY,
Nos. 7, 9 and 11 West 13th Street - - New York.



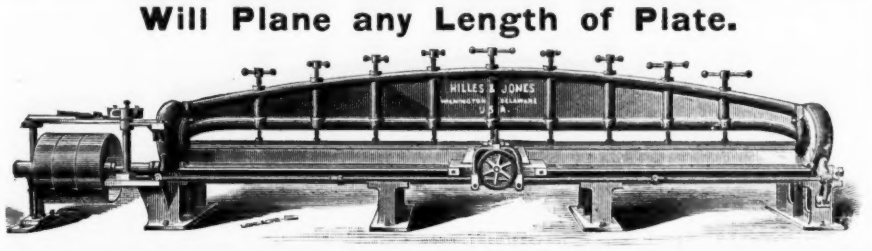
Champion Return-Steam Trap.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.
Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.

SOLID AND SHELL REAMERS, BEACH'S PATENT SELF-CENTERING CHUCK, BIT STOCK DRILLS, DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

BOILER PLATE PLANER.

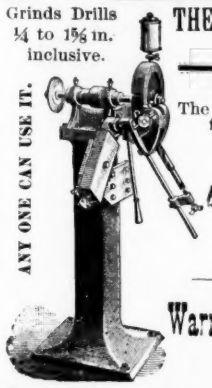
Will Plane any Length of Plate.



Tools cut both ways and have independent adjustment. Table acts as a gauge for setting the Plate. Driven by a Steel Screw, which is supported its entire length so that it cannot be bent or sprung. Three Sizes.

HILLES & JONES, Wilmington, Del.

Grinds Drills ¼ to 1⅝ in. inclusive.



ANY ONE CAN USE IT.

THE HOUGH TWIST DRILL
— GRINDER —

The SPECIAL CLAIMS made for this Tool are its

Simplicity, Ease of Operation, Low Price.

—MANUFACTURED BY—

Warner & Hough Machine Co.
ST. PAUL, MINN.

Manning, Maxwell & Moore, 111 Liberty St., New York. | Tallman & McFadden, 1025 Market St., Phila.

DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.

PECK'S PAT. DROP PRESS.
BEECHER & PECK. NEW HAVEN CONN.

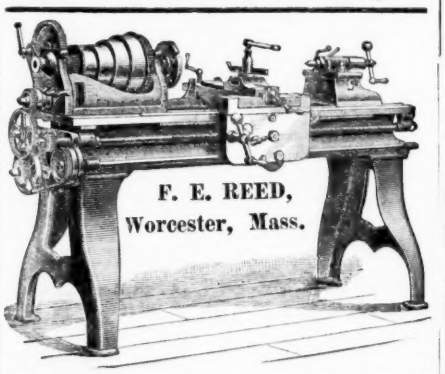
MACHINERY
For Reducing and Pointing Wire.

Especially adapted to pointing wire rods and wire for drawing.

For Machines or information, address the manufacturer.

S. W. GOODYEAR, Waterbury, Ct.

IF YOU ONLY KNEW HOW GOOD
THE
ELLIOTT CUTTING OFF TOOL
IS,
You would not sleep until you had ordered one.
STERLING ELLIOTT, NEWTON, MASS.

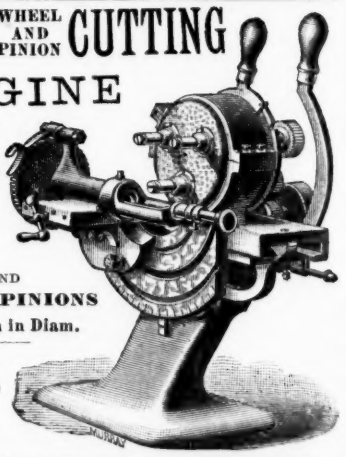


F. E. REED,
Worcester, Mass.

ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, Manning, Maxwell & Moore, 111 Liberty Street, New York.

No. 5 WHEEL AND PINION CUTTING ENGINE

Will Cut Brass Wheels to 5 Inches in Diameter, Spur, Bevel or Crown;
AND
STEEL PINIONS To 1 Inch in Diam.

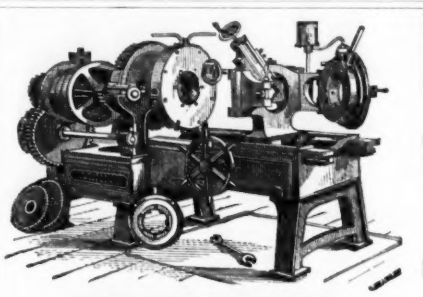


Send for D'scription and Prices.

SLOAN, CHACE & COMPANY
289-293 Washington St., Newark, N.J.
BUILDERS OF WATCH AND CLOCK MACHINERY.

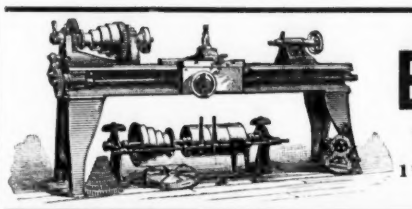
L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK



SEND FOR CIRCULAR.

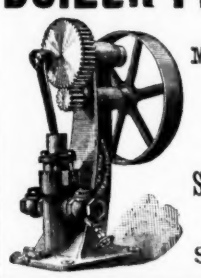
D. SAUNDERS' SONS,
Manufacturers of
Pipe Cutting & Threading Machines
For Pipe, Mill and Steam Fitters' Use.
TAPPING MACHINES,
For Steam Fitting, also
Steam and Gas Fitters' Hand Tools.
YONKERS, N. Y.



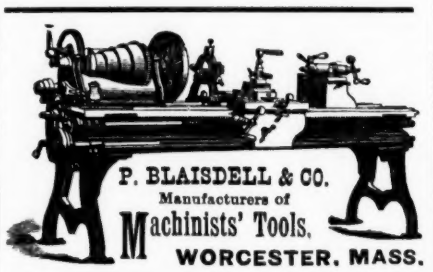
NEW AND IMPROVED
ENGINE LATHES.
THE MULLER MACHINE TOOL CO.
179 West Pearl St., CINCINNATI, OHIO.
Send for Cuts and Prices.

SHAPING MACHINES
For Hand and Power, 6", 8' and 10" Stroke.
Adapted to all Classes of Work to their capacity.
CIRCULARS FURNISHED.
BOYNTON & PLUMMER,
Worcester, Mass.

BOILER FEED PUMP
MADE BY
M. R. MUCKLE, Jr. & CO.
PHILADELPHIA,



SIZES TO SUIT STEAM PLANTS, UP TO 300 H. P.
Send For CirculaR

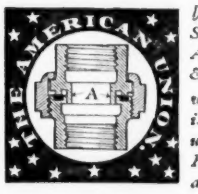


P. BLAISDELL & CO.
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

WHITE'S FLEXIBLE METALLIC FILLET
For use of Pattern Makers. Sizes 1 4 to 1 in.
HOWARD WHITE, 44 N. 4th ST., PHILA PA.

Send for Circular & Samples.

It will "Pay the Piper,"



If he aims to pipe well for STEAM, WATER, GAS, ACIDS, OILS, AMMONIA, &c., to examine this UNION, which requires no packing, but is always ready for instant use. When you next order Fittings of any Dealer, ask for a sample American Union to come with them, and it will tell you the whole story, or we will, if you write us for particulars.

PANCOAST & MAULE,
PHILADELPHIA, PA.

If you happen to take an Interest in doing First-class work about your establishment, send for a Circular of this Union.

Patent Flexible Back Hack Saw for Machinists' Use.

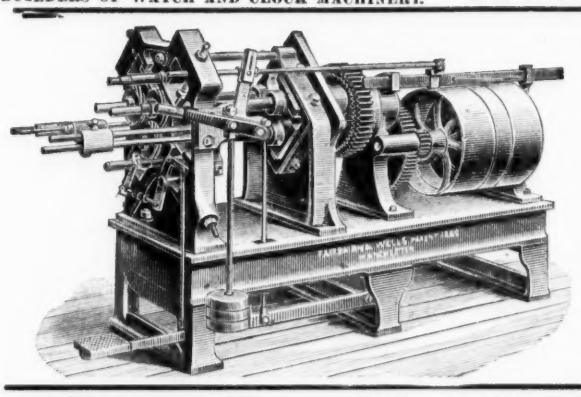
Made of best Band Steel. The teeth only are hardened by an entirely new process, the back remaining soft and flexible. Warranted not to break. Send for sample and circular. Endorsed by the Pratt & Whitney Co., John Henney, Jr., Supt. Motive Power, N. Y. & H. R. R. and others.
HENRY C. THOMPSON & SONS,
New Haven, Conn. | 51 Leonard St., N. Y

FRICTION
CLUTCH PULLEYS AND CUT-OFF COUPLINGS.
JAS. HUNTER & SON,
North Adams, Mass.

Iron and Steel
DROP FORGING
Of Every Description, at Reasonable Prices.
THE R. A. BELDEN CO., DANBURY, CT.

UNIVERSAL RADIAL AND RADIAL DRILLING MACHINES
THREE DESIGNS, SIX SIZES.
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI O U.S.A.

A New Departure in the Formation of Screws.



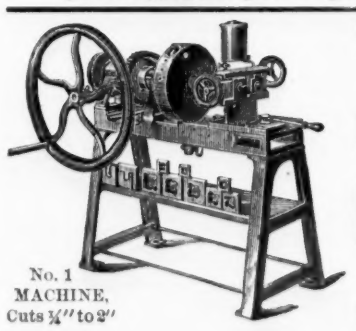
FAIRBAIRN & WELLS' SCREW FORGING MACHINE.

Secured by Patents dated 1871, 1875, 1877 and 1886, in England, France, Belgium, Germany, Sweden, Austria, United States and Canada.

By our **Patent Screw Forging Machine,** Screws can be made from ¼ in. up to any size required, any pitch or shape of thread, fitting Nuts accurately. Specially adapted for Fish-Bolts, Rise-Jacks, Stay Bolts, Car Bolts, Lag Screws, Bridge Rods, and all other forms of screws where strength and durability are required. By our process of Screw-Making, Screws, Bolts, etc., can be made 30 to 40 per cent. cheaper, and are 15 to 20 per cent. stronger, and more regular than when the threads are cut.

We are Prepared to Negotiate for the Sale of the American and Canadian Patents.

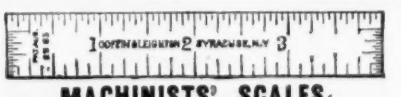
FOR FURTHER PARTICULARS APPLY TO
FAIRBAIRN & WELLS,
Room 10, Commercial Bank Building, Chicago, Ill.



No. 1 MACHINE, Cuts ¼" to 2"

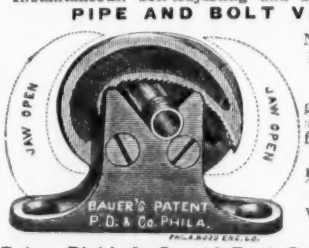
THE EATON, COLE & BURNHAM CO.
82 & 84 Fulton Street, New York,
MANUFACTURERS OF
PIPE CUTTING and THREADING MACHINES
OPERATED BY HAND OR POWER.
FITTINGS, VALVES, PIPE, PIPE TOOLS,
AND ALL STYLES OF IRON AND BRASS GOODS FOR
STEAM, WATER AND GAS.
Factory, Bridgeport, Conn.

PATENTS E. B. STOCKING, ATTY
Opp. Pat. Of. Washington, D.C.
Send sketch for free report as to patentability and new book on Patents



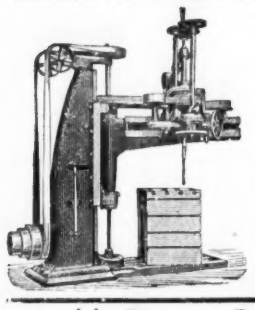
MACHINISTS' SCALES,
Patent End Graduation.
We invite comparison for accuracy with all others.
Every Scale Guaranteed. Send for List.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

BAUER'S PATENT
Instantaneous, Self-Adjusting and Self-Gripping
PIPE AND BOLT VISE.



No "kit" complete without a No. 1.
The new geared Jaws are in great favor.
No. 1 holds ⅛" to 1⅜" tubes.
Price $3.00; weight 3 lbs.
Get list.

Paine, Diehl & Co., 12 Bank St., Phila., Pa.



WILLIAM SELLERS & CO. INCORPORATED,

Engineers and Manufacturers of

IMPROVED MACHINE TOOLS FOR WORKING IRON AND STEEL

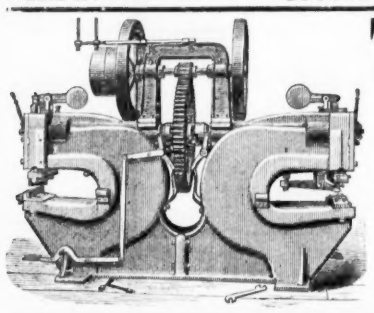
STEAM HAMMERS, PUNCHES and SHEARS, LATHES, PLANERS, BENDING ROLLS, BORING and TURNING MILLS, DRILL and TOOL GRINDERS, Etc., Etc.

SHAFTING, PULLEYS, HANGERS, COUPLINGS, Etc.

Improved Injectors for Feeding Boilers.

PAMPHLETS, PHOTOTYPES AND PRICES FURNISHED ON APPLICATION TO

OFFICE AND WORKS, PHILADELPHIA, PENN.



THE LONG & ALLSTATTER CO. Hamilton, OHIO.

Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

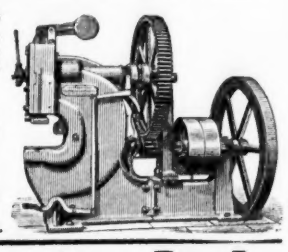
Punches and Shears.

Over 300 Sizes.

ALSO,

Power Cushioned Hammer.

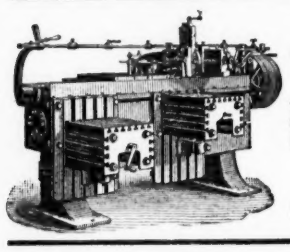
Send for new Catalogue.



Suckow's Patent Extension Jack

The best wrecking screw jack made, because of ready adjustment to unusual positions. The load can be in almost any position, allowing the screw to work freely without the use of packing strips or wedges to give equal bearings. A complete carrying or straight jack. Circulars and prices on application.

PEDRICK & AYER, Philadelphia, Pa.



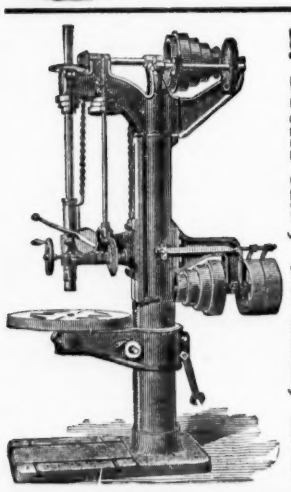
RICHARDS' PATENT

Combination Planer and Shaper.

Several sizes, any length of bed. Only the head travels, the work remaining stationary. Combines advantages of both planer and shaper. Effective, durable and convenient. A number in use, giving perfect satisfaction. Send for circular. Manufactured by

E. A. WALKER,

75 Laurel Street, Philadelphia.

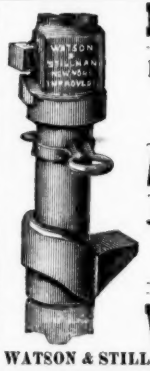


UPRIGHT DRILLS

A SPECIALTY,

ALL SIZES WITH PATENT QUICK RETURN-TEED AND ALL MODERN IMPROVEMENTS,

H. LICKFORD, Cincinnati, Ohio.



HYDROSTATIC MACHINERY,

PRESSES,
PUMPS.
PUNCHES,

ACCUMULATORS,

JACKS,
VALVES,
FITTINGS,

VAULT ELEVATORS, &c., &c.

WATSON & STILLMAN, 204-210 East 43d St., N. Y.

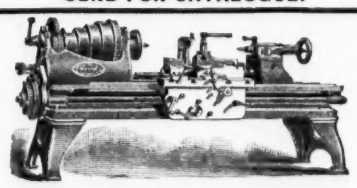
FAY & SCOTT, DEXTER ME.

MANUFACTURERS OF

WOOD LATHES,

Drill Lathes, Shaping Machines, Milling Machines, Planer Centers, Etc.

SEND FOR CATALOGUE.



NEW HAVEN MANFG. CO.

New Haven, Conn.

IRON-WORKING MACHINERY,

Planers, Shapers, Drills, Slotters, Etc.

— OUR — NEW CATALOGUE OF TOOLS

and Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).

CHAS. A. STRELINGER & CO., Wood Ave., Detroit, Mich.

HODGE'S

Universal Angle Union

PATENTED.

Combining an elbow and union, and can be set at any angle at which it is desired to run the pipe.

Manufacturers & Wholesale Agents,

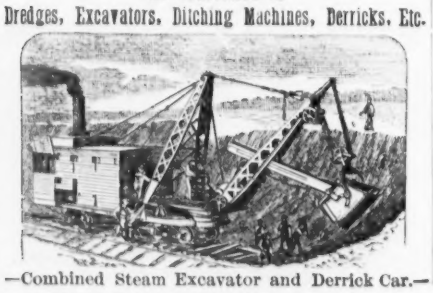
ROLLSTONE MACHINE CO., 45 Water St., FITCHBURG, MASS.

OSGOOD DREDGE CO., ALBANY, N. Y.

RALPH R. OSGOOD, Pres. JAMES H. BLESSING, Vice-Pres. JOHN K. HOWE, Secretary and Treasurer.

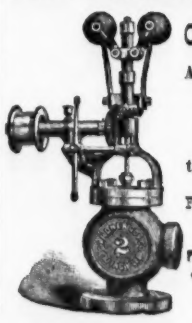
MANUFACTURERS OF

Dredges, Excavators, Ditching Machines, Derricks, Etc.



—Combined Steam Excavator and Derrick Car.—

THE GARDNER GOVERNOR



Over 45,000 in Use.

ADAPTED TO EVERY STYLE OF STATIONARY AND PORTABLE STEAM ENGINE.

Warranted to give satisfaction or no sale.

FOR CIRCULARS AND PRICES, ADDRESS,

The Gardner Governor Co,

QUINCY, ILL.

Southwark Foundry & Machine Co.

ENGINEERS AND MACHINISTS.

WASHINGTON AVE. AND FIFTH ST., PHILADELPHIA, PA.

PORTER-ALLEN and SOUTHWARK ENGINES, BOILERS AND TANKS,

BLOWING ENGINES, PUMPS, GAS APPARATUS, BESSEMER CONVERTERS, ETC.,

SUGAR MACHINERY, HYDRAULIC MACHINERY, ETC., ETC.

THE NATIONAL FEED WATER

HEATER.

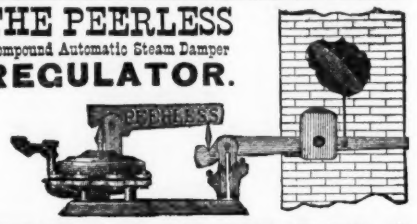
A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam. Our prices are low and reasonable, and we aim to supply the *cheapest, best and most effective Heater in the market.* Sixteen sizes. 10 H.P., $20; 100 H. P., $150; 500 H. P., $600. Iron, Brass and Copper Coils and Bends made to order. Circulars and price lists sent on application.

National Pipe Bending Co. NEW HAVEN, Conn.

THE PEERLESS

Compound Automatic Steam Damper

REGULATOR.



GUARANTEED THE BEST SAVER OF FUEL IN THE MARKET.

Has been used six years by 700 of the largest mills and firms in the U. S.; not one given out. Always put up by our own mechanics. Warranted to keep in order 5 years. Send for printed testimonial of large users.

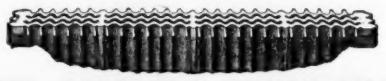
Buffalo Cupola & Forge Blowers.

Warranted superior to any other make.

All sizes and styles of every class of work.

BUFFALO FORGE CO. Buffalo, N. Y.

Send for Catalogue and prices.



THE PEERLESS GRATE BAR.

Warranted not to Warp, and the Most Durable in Use.

American Steam Appliance Co.

W. A. SIMMONS & CO., Sole Agents,

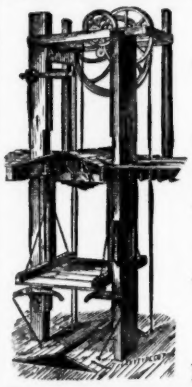
280 Broadway, New York, 22 & 24 N. 4th St., Phila.

MORSE ENGINEERING CO.

1306 Union Avenue, Kansas City, Missouri.

GENERAL AGTS. FOR THE SOUTH WEST.

MORSE ELEVATOR WORKS.



Morse, Williams & Co.,

(Successors to Clem & Morse)

Builders of all Kinds of

PASSENGER & FREIGHT

Elevators

Office, 411 Cherry St.

Works, Frankford Ave., Wildey and Shackamaxon Sts.,

PHILADELPHIA

New York Office, 108 Liberty St.

DIXON'S

Graphite Paint

FOR BOILER FRONTS.

Two coats will last two years. Send for circular

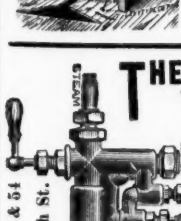
Joseph Dixon Crucible Co.

JERSEY CITY, N. J.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of

Engine Lathes, Hand Lathes,

FOOT POWER LATHES, SLIDE RESTS, Etc.



THE DUPLEX INJECTOR

THE BEST BOILER FEEDER KNOWN.

Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

JAMES JENKS & CO. Detroit, Mich.

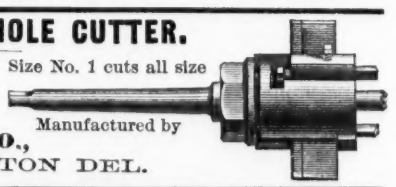
STANDARD PUNCHES FOR IRON & STEEL PLATES.

PATENTEES and others desiring specialties manufactured, will find unequaled facilities and low estimates by applying to THE JEWEL MFG. CO., Toledo, Ohio.

HARRISON'S ADJUSTABLE FLUE-HOLE CUTTER.

An effective labor-saving tool for the boiler shop. holes from 2 to 5 inches inclusive. The cutters proper are forged from ¾-inch round steel, can be renewed at trifling cost; are easily adjusted and firmly held.

Size No. 1 cuts all size



Manufactured by

REMINGTON & CO., WILMINGTON DEL.

IS A NATURAL PRODUCT TAKEN FROM OUR OWN MINES.

Unlike any of the artificial compounds or manufactured products heretofore on the market. We guarantee its success, if directions are followed, or *ask no pay.* Only 8 or 10 lbs. to the ton of iron required to purify the iron, and will more than pay for itself in keeping the cupola clean.

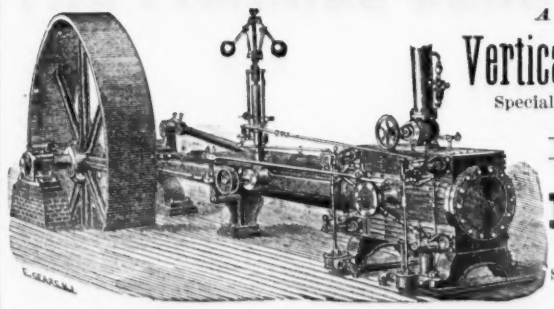
FLUOR SPAR — THE BEST — FOUNDRY FLUX

Send for Circular, Prices and Experience of Users.

THE EVANSVILLE LEAD & SPAR MINING CO., Successors to B. Burbank & Co., Evansville, Ind.

THE FISHKILL CORLISS ENGINE.

A FULL LINE OF SIZES.



Vertical Condensing Engines

Specially adapted for and extensively used in large grain elevators.

BOILERS.

Manufactured by the

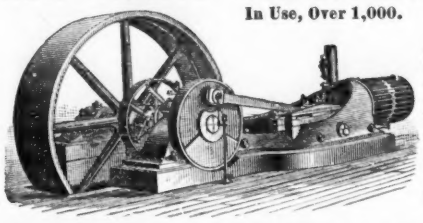
Fishkill Landing Machine Co.

FISHKILL-ON-THE-HUDSON, N. Y.

Send for Catalogue A, containing Illustrated Descriptions and References

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.

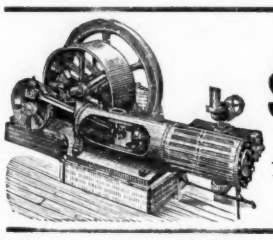


These Engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines, 12 to 100 H P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: W. L. SIMPSON, 70 Astor House, N. Y. { N W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. ROBINSON & CARY, St. Paul, Minn. PRAY MFG. CO., Minneapolis, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA,

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.



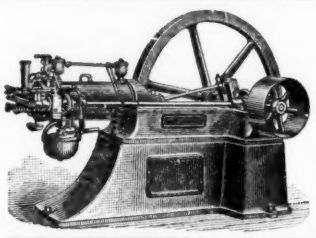
THE BECKETT & McDOWELL MFG. CO.,

STEAM ENGINES, HOISTS, PUMPS,

AND GENERAL MINING MACHINERY.

120 LIBERTY ST., NEW YORK.

☞ SEND FOR ILLUSTRATED CATALOGUE.



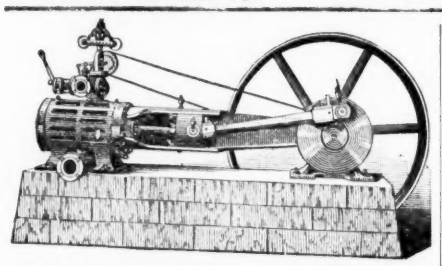
"OTTO" GAS ENGINE WORKS,

SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts. PHILADELPHIA. Branch Office, 130 Washington St. CHICAGO.

OVER 18,000 ENGINES IN USE.

GUARANTEED To Consume 25 to 75 Per Cent. Less Gas than ANY Other Gas Engine per Brake-horse-power.



STEARNS MFG. COMPANY,

ERIE, PA.

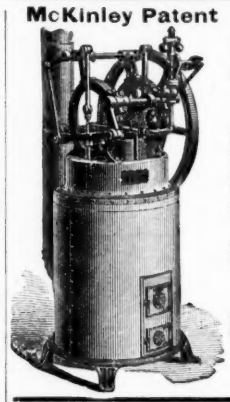
Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

McKinley Patent



Air Engine.

The Best and Cheapest on the Market.

No Steam. No Water. Absolute Safety. No Engineer. No Pumps. No Gauges. No liability to freeze up No Regulation required.

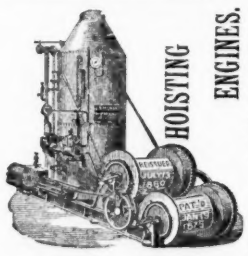
NO EXTRA INSURANCE.

Can be used for any purpose where power is required.

Cheap Fuel. Cheap First Cost.

McKinley Engine Co.

17 Broadway, CINCINNATI, O.



HOISTING ENGINES.

Of any power and Style. SINGLE AND DOUBLE CYLINDER, with improved patent friction drums, especially adapted for bridge building, dock building, pile driving, coal hoisting, quarries, mines, etc.

J. S. MUNDY, Newark, N. J.

This patent has been sustained in U. S. Courts in New York and N. J.

NEW TOOLS FOR SALE.

We have the following tools completed, or nearly so.

1 20 in. x 12 foot bed Engine Lathe.
1 26 in. x 25 " " " "
1 42 in. x 18 " " Treble Geared Lathe.
1 36 in. x 36 in. x 9 foot Planer, new design.
2 36 in. x 36 in., any length of bed Planers.
1 60 in Pulley Turning Lathe, two tools.

NEWARK MACHINE WORKS.

East Newark, New Jersey.

BEVEL GEARS,

Cut Theoretically Correct.

For particulars and estimates apply to

BREHMER BROS.

Machinists,

440 N. 12th St., Philadelphia, Pa.

DRAWING INSTRUMENTS

Send for 72-Page ILLUSTRATED CATALOGUE.

WM. T. COMSTOCK, 6 Astor Place, - New York.

MACHINERY,

NEW AND SECOND-HAND.

12 in. S., 5 ft. Bed Engine Lathe, New
14 " 5 and 7 ft. Bed Engine Lathe, Bogert new
14 " 5½ ft. " " " Harris, cheap
16 " 6 ft. " " " Ames.
15 " 6 ft. " " " Pratt & Whitney.
17 " 6 ft. " " " Putnam, not screw cutting
17 " 6', 7' " " Hewes & Phillips.
18 " 8 ft. " " " Fitchburg, g. o.
19 " 10,12,14" " " Pond, nearly new.
24 " 20 ft " " " Ames, new.
30 " 12 ft. " " " Harrisburg.
34 " 12 ft " " " Harrisburg, good.
16x6 ft. Turret Lathe with chasing bar
14 in.-20 in. and 33 in. Turret Head Chucking, or Screw Machines, Bridgeport.
23 in., 25 in. and 28 in. Drills, Blaisdell, new.
20 in. Drill, Prentice.
32 " " Pond. Slate's Sensitive Drill.
Elliott Drill. Gang Drill.

SHAPERS.

8 in. Gould. 12 in Sellers.
8 in. Boynton & Plummer 15 & 24 in. Wolcott.
24 in. Hendey, 24 in. Bridgeport.

PLANERS.

16x42 in. Bridgeport. 18 in x 3 ft., Wheeler,
24 in x 6 ft., Powell. 24 in x 8 ft. Ames.
26 in. x 6&8 ft., "
32 in x 10 ft , Pond 34in. x 10 ft , P. & W.
36 in. Squaring Shear, power, nearly new.
No. 3½ and 4 Press, Stiles
25-40 lb Bradley Cushioned Hammer.
Lot of miscellaneous Machinery If you do not see what you want, write and state what is required.

E. P. BULLARD, 14 Dey St., New York.

MACHINERY.

NEW and SECOND-HAND.

LATHES.

One.. 17 in. x 6 ft. Forsaith Engine Lathe, 2nd-hand
One.. 18 in. x 12 ft. " " "
One.. 16 in. x 6 ft., Fifield, " "
One.. 20 in. x 8 ft. " " "
One.. 21 in. x 8 ft., " " "
One.. Cabinet Turret Lathe. Am. Tool Co., "
Five No. 3 Plain L. D. & Co., Hand Speed Lathe, New
One.. 26 in. x 16 ft., " " Engine Lathe "
Five 13 in-x 5 ft. " " Turret " New
Three No. 1 " " Hand, Fox " "
Four 15 in. L. D. & Co. Fox Monitors " "
One.. 12 in. " " " " "
Ten 19 in. x 8-10-12" " all in A No. 1 order

PLANERS.

One..22 in. x 22 in x 6 ft. Powell (good as new), 2d-h'd
One..30 in x 30in x 8 ft. Pond, "
One.. 24 in. x 24x 6 ft Wood & Light " "
One..18 in. x 16x3ft. 6 in. Putnam New
One..24x24in. x 6 Pease New
Two 30 in. L. D. & Co. Shapers, New
Two 26 in " " " "
One..32 in. " " " "

DRILLS.

Six ..24 in. Bickford Drill, New
One..24 in. Bickford Drill, 2nd-hand
One..20 in. L. D. & Co. Lever Drill, "
Six ..20 in. L. D. & Co. " " New
Three 28 in. Bickford B. G. & S. F. Drill "
Three 32 in. " " " " "

MISCELLANEOUS.

Two Grant & Bogert Universal Millers, New
One..Small Valve Miller, "
One..Sellers Car Wheel Borer, 2nd-hand

☞ (See Advertisement on page 16.)

LODGE, DAVIS & CO.

Manufacturers and Dealers,

CINCINNATI, OHIO.

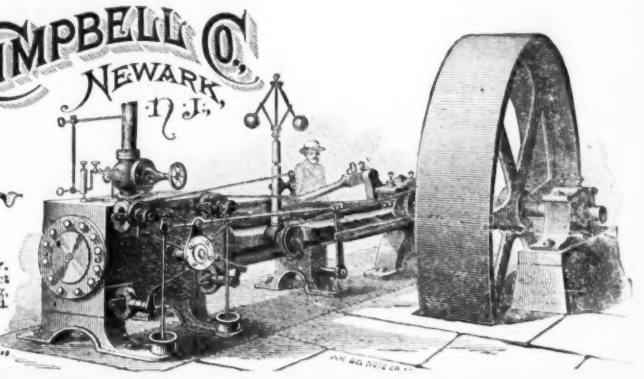
The Watts, Campbell Co.,

Newark, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

Sizes varying from 30 to 2000 Horse Power. Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound. Send for Circular.

BRANCH OFFICE: Cor. 5th and Chestnut Sts., PHILADELPHIA, PA.



HEWES & PHILLIPS Iron Works.

IMPROVED

Corliss Engine,

High Pressure,

—Condensing—

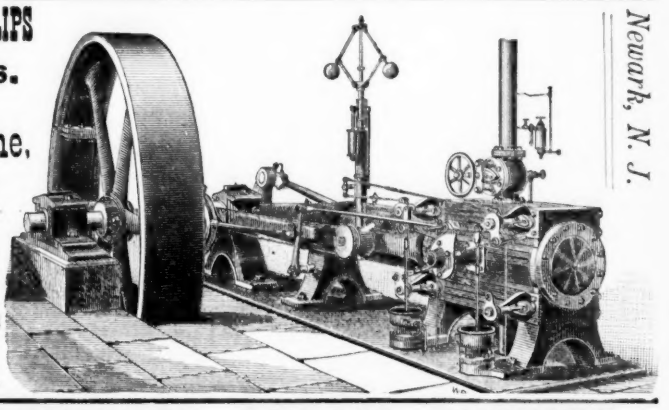
And Compound

Send for Circular.

Kendall & Roberts

CAMBRIDGEPORT, MASS.

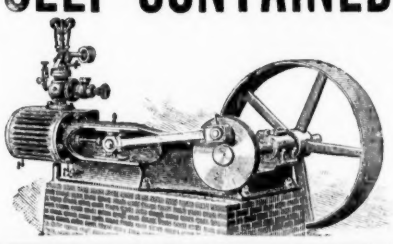
EASTERN AGENTS.



Newark, N. J.

SELF-CONTAINED STEAM ENGINES.

Stationary or Semi-Portable.



High Standard Maintained. Prices greatly Reduced. Write for New Illustrated Catalogue No. 22

CHANDLER & TAYLOR, Indianapolis, Ind.

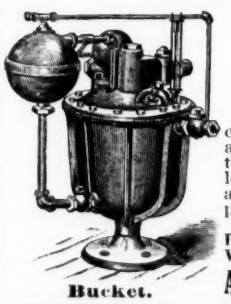
ENGINES, SAW MILLS, AND DRAIN TILE

MACHINERY A SPECIALTY.

THE ALBANY STEAM TRAP CO.'S

BUCKET AND GRAVITATING

TRAPS.

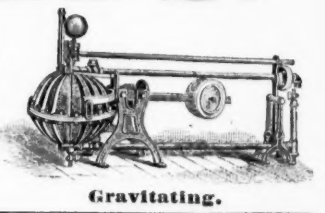


Bucket.

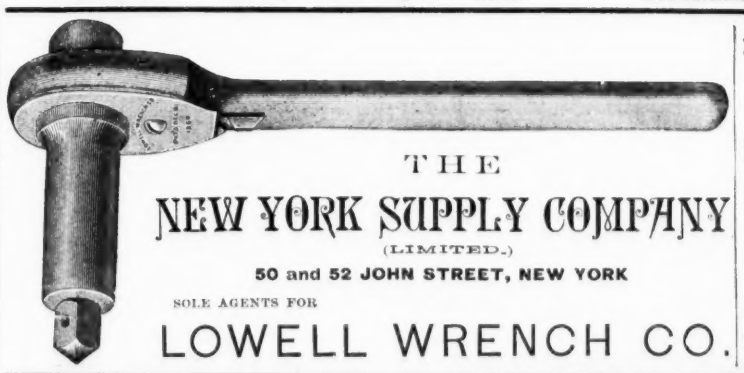
Automatically drain the water of condensation from **HEATING COILS** and return it to the boilers whether the coils are **above** or **below** the water level in boiler, doing away with pumps and other mechanical devices for such purposes.

We also manufacture **Blessing's Patent Renewable Seat Stop and Check Valves.**—Send for Circular.

Albany Steam Trap Co. Albany, N. Y.



Gravitating.



THE

NEW YORK SUPPLY COMPANY

(LIMITED.)

50 and 52 JOHN STREET, NEW YORK

SOLE AGENTS FOR

LOWELL WRENCH CO.

Railway, Machinists, Engineers, Mill and Miners Supplies.

FRICTION CLUTCH PULLEYS,

HOISTING ENGINES, ELEVATORS, STEAM AND BELT POWER.

D. FRISBIE & CO., 112 Liberty St., N. Y.

EXTRA HEAVY LATHE

WE ARE MAKING A SPECIALTY OF A 24-INCH LATHE, WITH BED ANY LENGTH DESIRED. THIS LATHE IS DESIGNED FOR SEVERE SERVICE; IT IS THE HEAVIEST OF ITS SIZE EVER PRODUCED, AND THE WORKMANSHIP AS GOOD AS SKILL CAN MAKE IT.

SEND FOR CIRCULAR.

S. S. HEPWORTH & CO., "Glenwood Station," Yonkers, N. Y.

I. W. COLBURN & Co. FITCHBURG, MASS. 100 MAIN ST.

LOWEST LIVING PRICES ARC AND INCANDESCENT LIGHTING AND PLATING MACHINES.

SECOND-HAND TOOLS FOR SALE by POOLE & HUNT, Baltimore, Md.

1 Planing Machine. Will plane 35in. wide, 27 in. high, and 16 ft. 6 in. long.
1 Planing Machine. Will plane 30 in. wide, 26 in. high, and 5 ft. 6 in. long.
1 Planing Machine. Will plane 24 in. wide, 22 in. high, and 5 feet long.
1 Double Geared Chasing Lathe. Will swing 24 in. dia., 8 ft. 6 in. long.
1 Drill Grinding Machine.
1 Small Punching and shearing Machine, with fly wheel and clutch starting arrangement.

SEND FOR SPECIAL LIST.

New and Second-hand Machinery.

COLD-ROLLED SHAFTING, HANGERS, PULLEYS, ETC., ETC.

GEORGE PLACE MACHINERY CO.

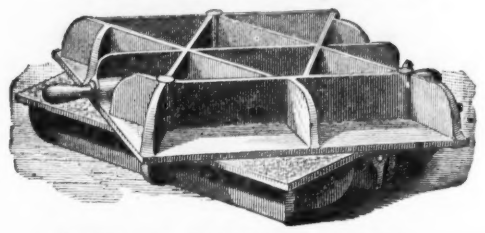
121 Chambers St., New York.

BROWN & SHARPE MFG. CO.,

MANUFACTURERS OF

MACHINERY AND TOOLS

PROVIDENCE, R. I.



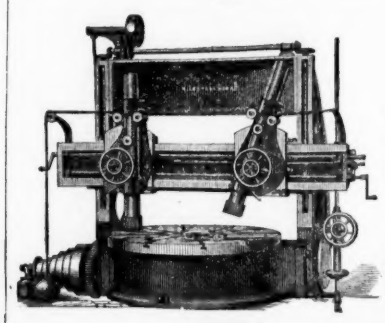
SIZES OF SURFACE PLATES.

4½ in. x 6 in.	9 in. x 9 in.	12 in. x 12 in.	16 in. x 16 in.
6 in. x 6 in.	9 in. x 14 in.	12 in. x 18 in.	18 in. x 18 in.
6 in. x 12 in.	10 in. x 15 in.	14 in. x 14 in.	18 in. x 36 in.
6½ in. x 18 in.	10 in. x 30 in.	14 in. x 18 in.	24 in. x 24 in.
		36 in. x 66 in.	

Illustrated Catalogue Mailed on Application

Boring and Turning Mills,

5, 6, 7, 8, 10, 12, 14 and 16 FT. SWING.



NEW MACHINE,

14–20 ft. Boring and Turning Mill. Housings and upper works arranged to slide back to take in work 20 ft. diameter. Has independent boring and key seating attachment.

NILES TOOL WORKS

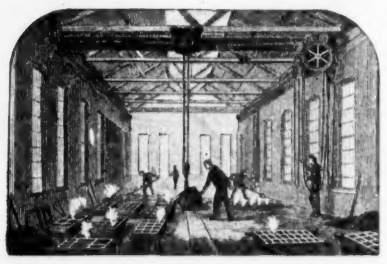
Hamilton, Ohio.

NEW YORK, 96 Liberty Street. PHILADELPHIA, 713 Chestnut Street. CHICAGO. 96 Lake Street.

HAND POWER

Traveling Crane

—FOR FOUNDRY USE.—



FOUNDRY TRAVELER.

Particulars on application. Full Specifications and Tender promptly submitted on receipt of capacity and span of bridge desired.

SOLE MAKERS,

THE YALE & TOWNE MFG. CO.

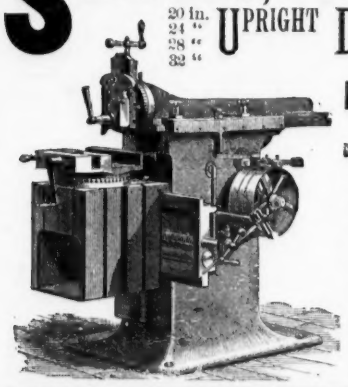
Catalogues on application.

STAMFORD, CONN.

NEW YORK — CHICAGO — PHILADELPHIA — BOSTON.

SHAPERS, TURRET LATHES AND DRILLS

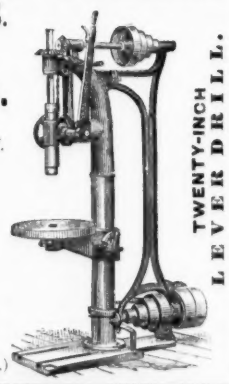
20 in. 24 " 28 " 32 " UPRIGHT DRILLS, 28 in. 32 " Back-geared and Power-feed DRILLS.



LODGE, DAVIS & CO.

CINCINNATI, OHIO.

Send for Prices, IT WILL PAY YOU.



TWENTY-INCH LEVER DRILL.

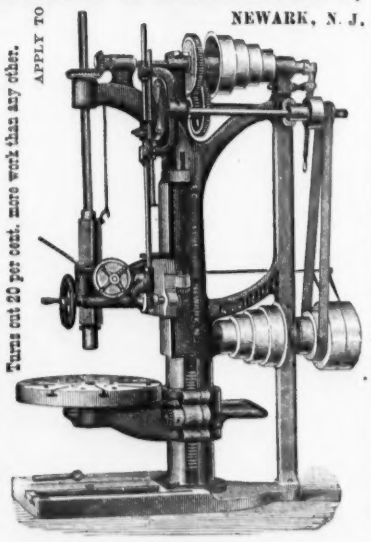
(See our advertisement on page 15.)

EBERHARDT'S NEW DRILL

Turns out 20 per cent. more work than any other.

APPLY TO

E. GOULD & EBERHARDT, NEWARK, N. J.



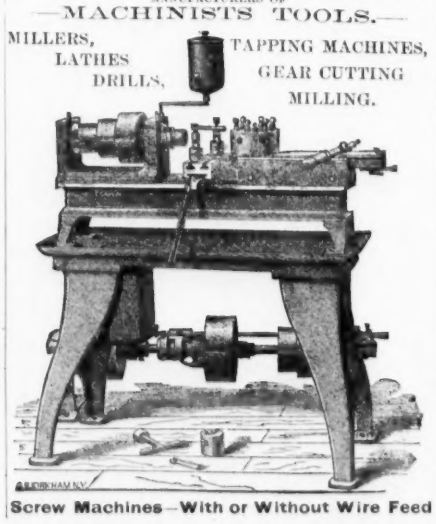
E. E. GARVIN & CO.

No. 139, 141, 143 CENTRE STREET, NEW YORK.

MANUFACTURERS OF

—MACHINISTS TOOLS.—

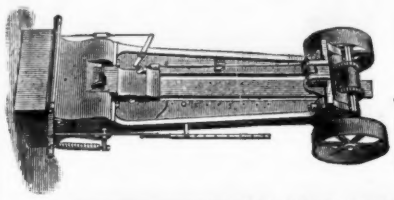
MILLERS, LATHES DRILLS, TAPPING MACHINES, GEAR CUTTING MILLING.



Screw Machines—With or Without Wire Feed

THE PRATT & WHITNEY CO.,

—HARTFORD, CONN.—



MANUFACTURE

DROP HAMMERS,

PUNCHING AND TRIMMING PRESSES,

—POWER SHEARS,—

Die-Sinking Machines, Hand Bolt Heading, Power Screw and Bolt Blank Heading Machines,

RETRACTILE JIB CRANES,

Roll Grooving Machines for Flour Mill Use.

—PRICE LIST FURNISHED ON APPLICATION.—

THE BILLINGS AND SPENCER CO. HARTFORD, CT., U. S. A.

MANUFACTURERS OF

BILLINGS' DOUBLE-ACTING

RATCHET DRILL

For Morse Taper Shank Drills.

Packer Ratchet Drills.

Packer Boiler Ratchet Drills,

Packer Auger Ratchet Drills,

DROP FORGINGS

OF EVERY DESCRIPTION.

WARNER & SWASEY,

CLEVELAND, OHIO,

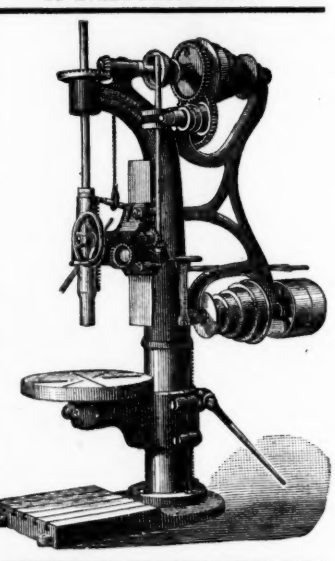
MACHINE TOOLS

For Iron and Brass Work.

SMALL TOOLS & FIXTURES.

Gear Cutting in all its Branches.

ILLUSTRATED CATALOGUE ON APPLICATION.



Engine Lathes, Planers, Drills, Etc., Pond Machine Tool Co., Successors to David W. Pond, WORCESTER, MASS.

New Designs, Quick Delivery, Great Variety.

GEO. W. FIFIELD,

MANUFACTURER OF

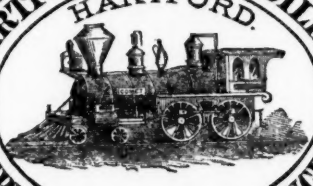
ENGINE LATHES

FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



HARTFORD, CONN.

J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

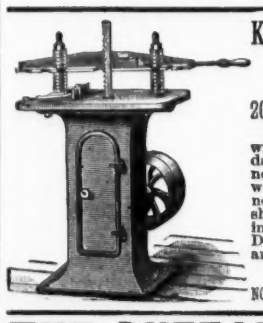
J. B. PIERCE, SECRETARY.

GEAR WHEELS & GEAR CUTTING

Send for Catalogue D.

GEORGE B. GRANT,

666 Beverly Street, Boston.



KEY-SEATING MACHINES AND 20-in. Drills a Specialty.

Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key-Seating Machines and 20-inch Drills. Send for Photo. and Catalogue.

W. P. DAVIS,

NORTH BLOOMFIELD, N. Y.

Lathes, 17 in. 20 in. Planers 24"x24' 30"x30'

For New Reduced PRICE LIST, Write

THE G A. GRAY CO.

Sycamore & Webster St., Cincinnati, O

THE BUFFALO STEEL FOUNDRY, BUFFALO, N. Y.

ORDERS AND CORRESPONDENCE SOLICITED.

PRATT & LETCHWORTH Proprietors.

The Stiles Machinist Tool Grinder.

FOR GRINDING LATHE, PLANER AND OTHER TOOLS,

—MANUFACTURED BY—

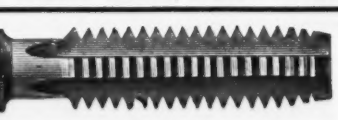
THE STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Works and Office:

203, 205, 207 Centre Street, corner of Howard, New York.

J.M.CARPENTER PAWTUCKET.R.I.



Manufacturer —of— TAPS AND DIES